DOCUMENT RESUME

ED 404 284 SO 027 528

AUTHOR	Stewart, Kelly
TITLE	Architecture. Intermediate ThemeWorks. An Integrated Activity Bank.
REPORT NO	ISBN-0-7622-0005-7
PUB DATE	96
NOTE	70p.
AVAILABLE FROM	Creative Publications, 1300 Villa Street, Mountain View, CA 94041-1197.
PUB TYPE	Guides - Classroom Use - Teaching Guides (For Teacher) (052)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Architectural Education; *Architecture; Art Activities; Art Education; Grade 4; Grade 5; Grade 6; Instructional Materials; Interdisciplinary Approach; Intermediate Grades; Learning Activities; Structural Elements (Construction); Thematic Approach; Units of Study; Visual Arts

ABSTRACT

This resource book offers an activity bank of learning experiences related to the theme of architecture. The activities, which are designed for use with students in grades 4-6, require active engagement of the students and integrate language arts, mathematics, science, social studies, and art experiences. Activities exploring the architectural theme include: (1) "Form and Function"; (2) "I Am an Architect"; (3) "On the Construction Site"; (4) "Building Materials"; (5) "All about Structure"; (6) "Environmental Influences"; (7) "Egyptian Pyramids"; (8) "Classical Greek Order"; (9) "Roman Arch and Vault"; (10) "Medieval Castles and Cathedrals"; (11) "Chinese and Japanese Style"; (12) "Islamic Architecture"; (13) "Pre-Columbian Architecture"; (14) "Native American Dwellings"; (15) "At Home in North America"; (16) "Looking at Modern Architecture"; (17) "Touching the Sky"; (18) "Building Bridges"; (19) "Outdoor Design"; (20) "Architects in the Animal World"; and (21) "Final Presentation." This resource includes blackline masters, a curriculum chart listing each subject area and the learning goals for each activity, and a 56-item resource list. (MM)

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ED 404 284

INTERMEDIATE

ThemeWorks™

An Integrated Activity Bank

ARCHITECTURE

Kelly Stewart

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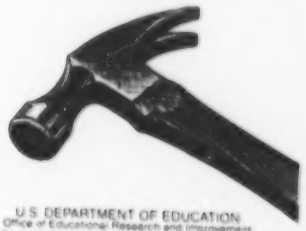

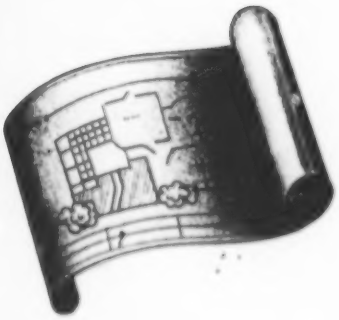

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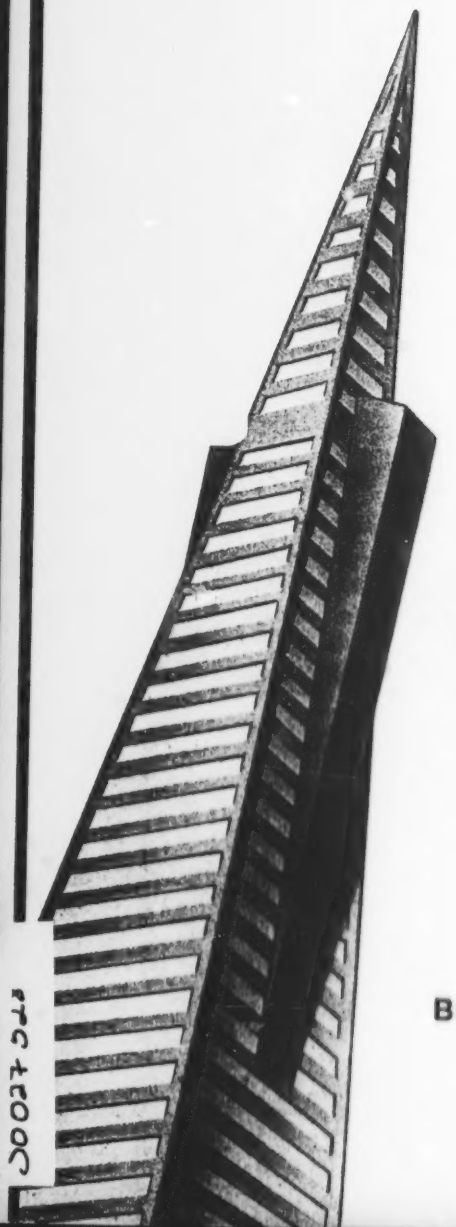

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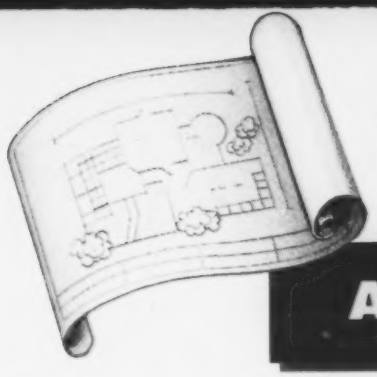

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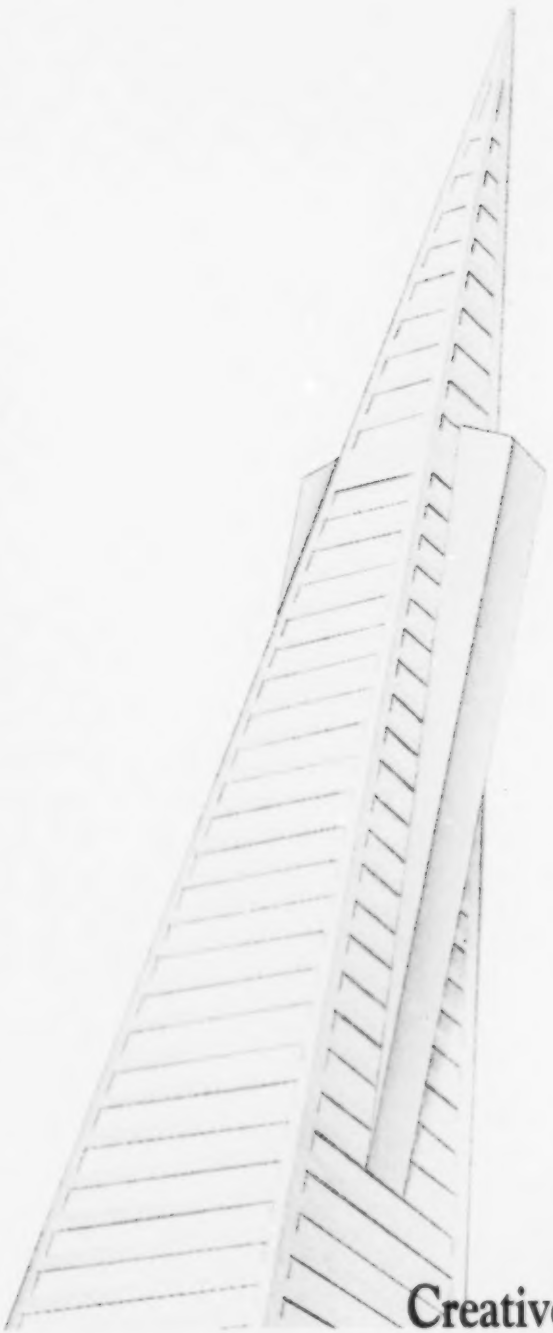
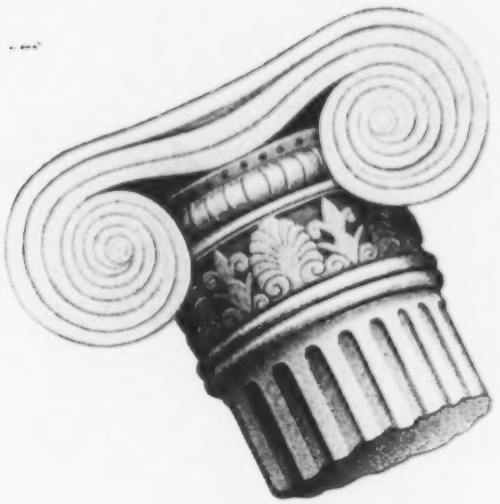
Kelly Stewart





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Grateful acknowledgment is made to the teachers who reviewed these materials:

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The Integrated Curriculum

Intermediate ThemeWorks is part of a full line of Integrated Curriculum resources available from Creative Publications. Creative Publications' Integrated Curriculum Group is committed to developing high-quality teacher's resource materials to support learning that bridges all the curriculum areas. We believe students learn best when they are motivated by engaging topics that provide a rich context for high-level inquiry, thought, and communication.

For more information about all the excellent teaching materials for integrated learning available from Creative Publications, call 1-800-624-0822.

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ISBN: 0-7622-0005-7

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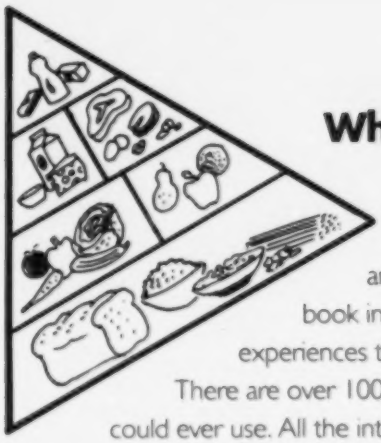
Teaching Notes



What is ThemeWorks™?

ThemeWorks is a series of teacher resource books created especially for teachers who wish to use an integrated approach to teaching the curriculum. Each book in the *ThemeWorks* series offers an activity bank of learning experiences teachers can pick and choose from related to a theme. There are over 100 activities described in each book—more than anyone could ever use. All the interesting ideas for activities that the theme stimulates are explored in active and interesting ways. Rather than passively reading about the topic or theme, or being lectured on it, students learn the content through their active engagement in the activities.

Why use an integrated approach?

In an integrated approach to curriculum, the topic or theme, not the subject area, is the focus of the learning. As students investigate the theme, they engage naturally in language, math, science, social studies, and art. Because students want to know more about the theme, they are motivated to learn and they tend to retain what they learn better.

How were the themes chosen?

There are hundreds of possibilities for themes, but the best themes are those that provide the potential for a broad range of activities across all the curriculum areas. Themes were chosen that provide

- a balance of types of activities in all the subject areas;
- a rich source of literature, both fiction and nonfiction, including poetry;
- a high-interest topic for students at the grade levels.

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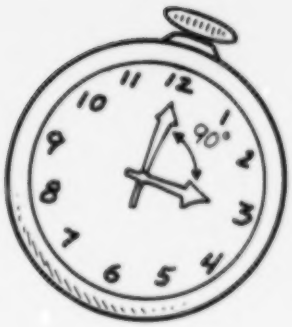
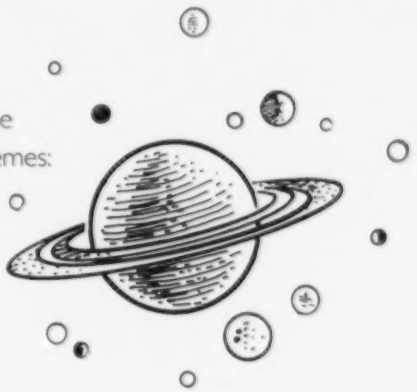


The first series of *ThemeWorks* books was developed for the primary grades. These books address the following themes:

Night Time
Rain
Houses
Trees
At the Seashore
Under the Ground



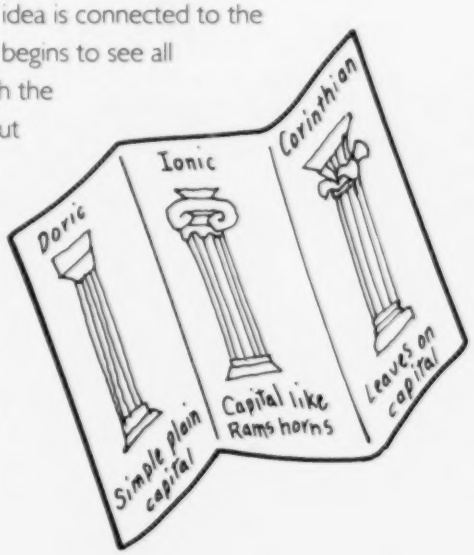
A second series of books was then created for the intermediate grades. The *Intermediate ThemeWorks* books focus on these themes:

Flight
Architecture
Human Body
Time
Space

How do I start up a theme?

It is always a good idea to kick off a theme exploration by discussing what students already know about the topic and what they would like to find out. Activities at the beginning of a unit focus on topics students are familiar with before they begin to expand their thinking and knowledge about the topic.

The beginning of the unit is a good time to begin a theme web. A web is a brainstorming tool and graphic organizer. At the center of the web is the name of the current theme. As students name subtopics of the theme, each idea is connected to the center by lines. Through this brainstorming process, the class begins to see all the avenues of exploration that are available to them through the vehicle of the theme. Work on the web can go on throughout the investigation of the theme. A sample web is shown on page T4.



You may also want to begin a word bank for the theme. A word bank is a dictionary of words related to the theme. Entries for the word bank may be suggested by the students anytime throughout the exploration of the theme. Examples are often given in the side column of each topic spread.

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How is each theme organized?

Each theme is organized into about 20 mini-topics related to the theme. Activities for each mini-topic are presented on a two-page spread. By scanning the table of contents, a teacher can choose those topics that are most appropriate for the class's study of the theme.

Many of the spreads list fiction and nonfiction books relevant to the exploration of the subtopic. You may want to find these books at the library. These books and other resources, such as multimedia, are listed in a resource list at the back of the book.

How do I know what the curriculum content is?

At the end of each *ThemeWorks* book, there is a curriculum chart listing each subject area and the learning goals for each mini-topic. Through the curriculum chart, teachers can see the many subject areas explored and the balance of subject areas achieved.

Curriculum Chart

	Language Arts	Math	Science	Social Studies	Art	Physical Education
Dreams of Flying pp. 2-3	• literature • brainstorming • creative writing • creating a web	• measuring time • recording data	• observing		• sketching • making a model of a black box	• long jump
Free Flight pp. 4-5	• researching the meaning of words		• investigating air and flight • predicting	• brainstorming parachute-related jobs	• making gliders • making parachutes	• parachute gymnastics
	• poems					

How does the theme end?

Throughout the theme exploration, students create reports, artwork, projects, and constructions. A good way to end a theme is to spend some time focusing on all the work students did and how much they have grown in their understanding of the theme. In addition, at the end of each *ThemeWorks* book are suggestions for culminating activities or an event that can serve as the grand finale of the topic exploration.

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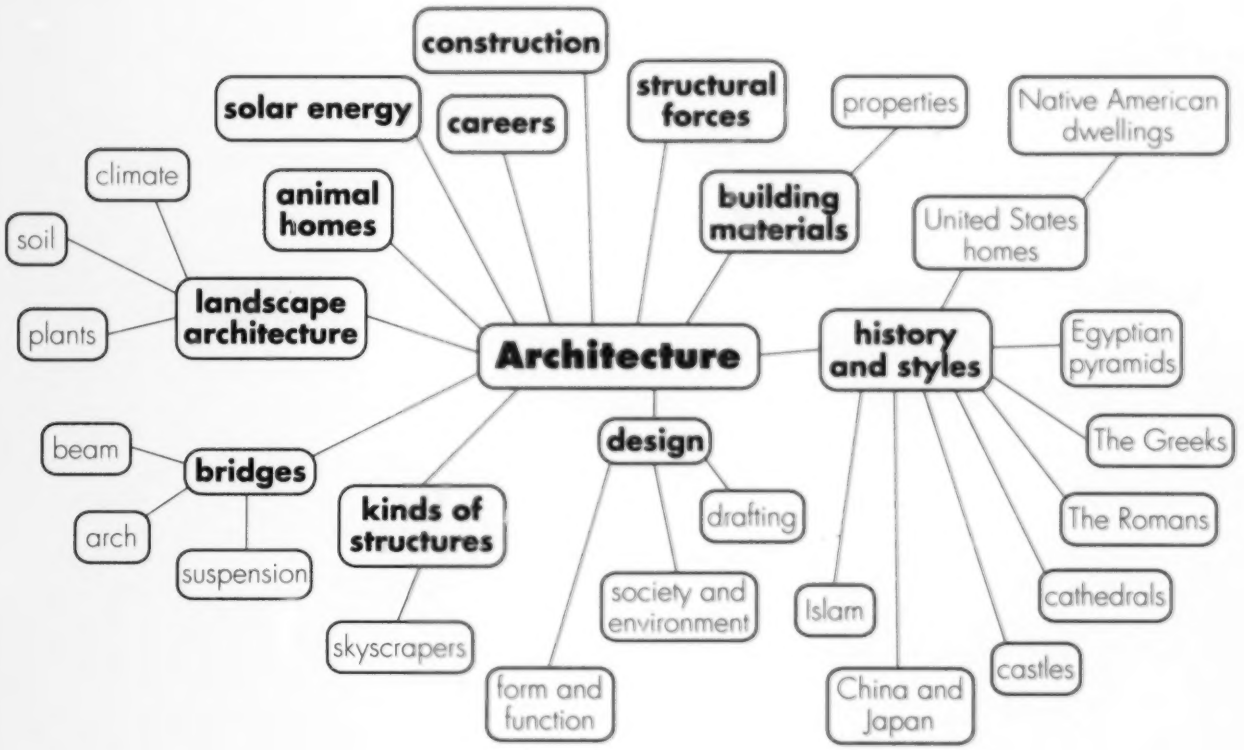
Architecture

Architecture is all around us. During this theme, students will benefit from field trips to local buildings, bridges, and gardens to see and touch the architecture that exists in their world. Illustrative magazines and books on architecture will extend students' worlds to places they can visit in their imaginations.

The theme starts off with the creation of a portfolio—the students' own collection of their work throughout the theme. They learn how the shape and function of a building are equally important. They investigate forces on buildings and examine different types of architecture in their town and in the world. Students learn how both environment and people play a role in the development of architecture. Students test the strength of bridges they build and make a site development plan for an area in their community. Animals have their own architecture, and students research the amazing structures animals build. At the end, students plan an Architecture Night and display models of buildings, dress up in period and ethnic costumes, and prepare food of different cultures and periods.

A Web for Architecture

A brainstorming web will help students start thinking about architecture topics that they can explore further. A sample web is shown below.



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Dear Family:

Our class is planning an exploration of a new theme—Architecture. Students will look at the architecture in their neighborhood and in the world. Students will examine how closely society and its architecture are tied together by exploring the architecture of different civilizations, such as the Egyptians, the Greeks, and the Romans. Students will discover why flying buttresses help keep Gothic cathedrals standing, and they will write skyscraper poems. Students will study the forces on buildings, and they will build bridges, testing their strength. They will plan a landscape and wonder at the architecture of the animal world. As a culmination, students will plan an Architecture Night where they will display three-dimensional models of buildings. Throughout the theme, students will be using math, science, social studies, art, and language arts skills to investigate this theme.

How can you help? If you have magazines, books, videotapes, or software about architecture, we would love to borrow them. Are you an architect? A contractor? A landscaper? An engineer? We would enjoy having you or someone you know visit our classroom. Any resources you have will benefit our experience.

Your enthusiastic participation in our study of this theme makes a valuable contribution to our students' learning. Thank you!

Sincerely,

Your child's teacher

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Form and Function

What Is Architecture?

The term *architecture* has several building-related meanings. It may refer to the art and science of building, or it may mean the buildings themselves. The term also may refer to the building style of a particular culture or to an artistic movement. Have students brainstorm a class chart of what they know about architecture and what they want to learn. As they study this theme, they can fill in the column about what they learned.

Architecture

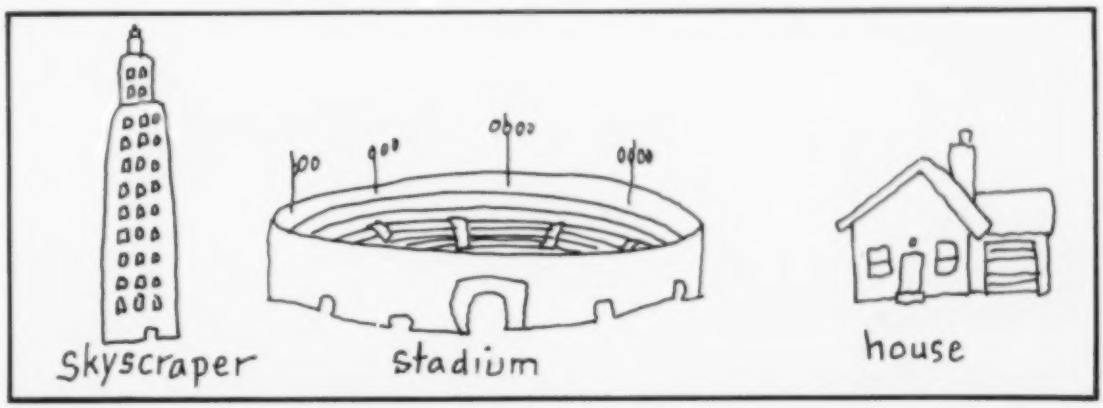
What We Know	What We Want to Find Out	What We Learned
Architects use blueprints.	How are buildings built?	
There are different types of buildings in the city than in the country.	How do skyscrapers stay up?	
Architects have to think about the needs of people in wheelchairs.	What do architects do?	
	What are the strongest building materials?	

Mural About Structures

Architects create many kinds of structures. Students can brainstorm a list of structures including houses, theaters, hotels, stadiums, museums, places of worship, hospitals, schools, office buildings, bus stations, and so on. Have students paint a mural of different structures and label them.

Architectural Form

Architecture can take many forms. Students can clip pictures of structures from old design or architecture magazines or from newspapers. They can write a caption for each clipping describing what they like, or don't like, about the structure's form.



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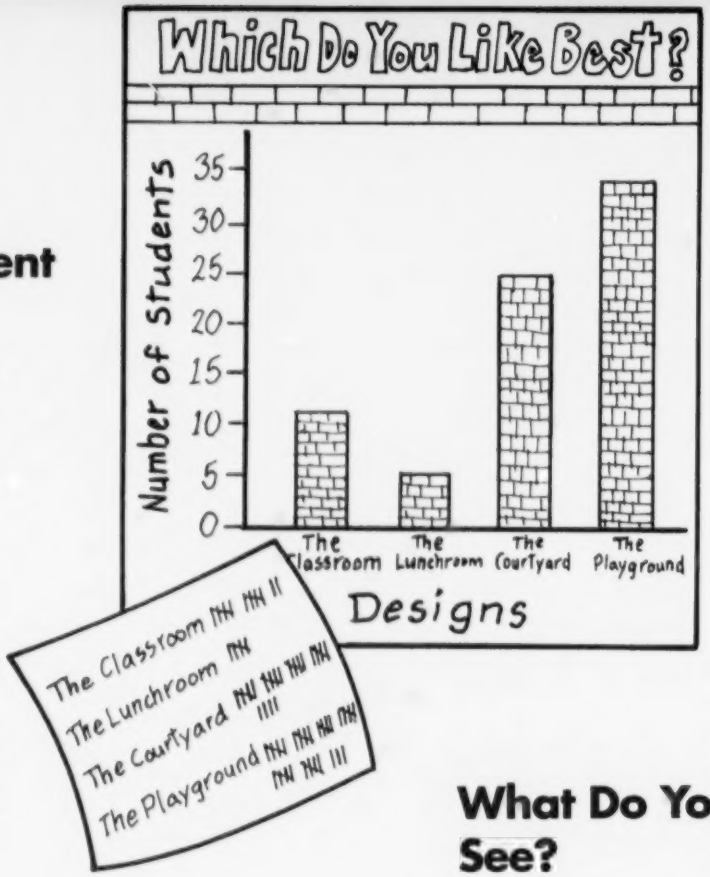
School Improvement

The American architect Louis Sullivan believed that "form follows function." He meant that the purpose for which a building is designed indicates what shape it should take. Could the design of the school be improved so that it would be more functional? Could a door, window, play area, or lunchroom be located more conveniently? What do students like about the design? What don't they like about it? Students can present their findings graphically and write a list of school improvements. Then students can design a school that is nonfunctional. Post the designs on the bulletin board and have students guess what is nonfunctional about each design.



Functionality

Every building is designed for certain purposes. A functional building—whether a house or a university—must serve the needs of its users in a way that is convenient. For example, a bedroom should not be located in a noisy area of a house. Students can list other things an architect should consider when designing a home.

What Do You See?

Give students sketch pads and pencils and take a field trip downtown. Point out a building and give students one minute to make a sketch of it. Then gather the students together and ask them what they noticed first. Continue having students sketch for one-minute intervals. Students can identify the shapes in each structure they sketch.

My Portfolio

Architects keep portfolios of their work to share with prospective clients or employers. Students can keep a portfolio of their work—their sketches, designs, ideas, notes, definitions, and other things they learn about architecture throughout the theme.

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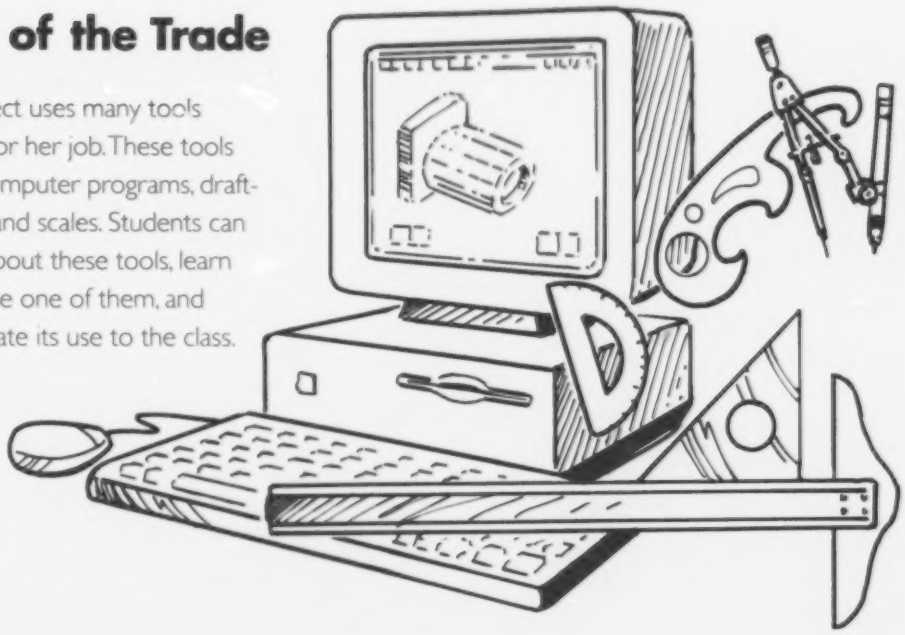
I Am an Architect

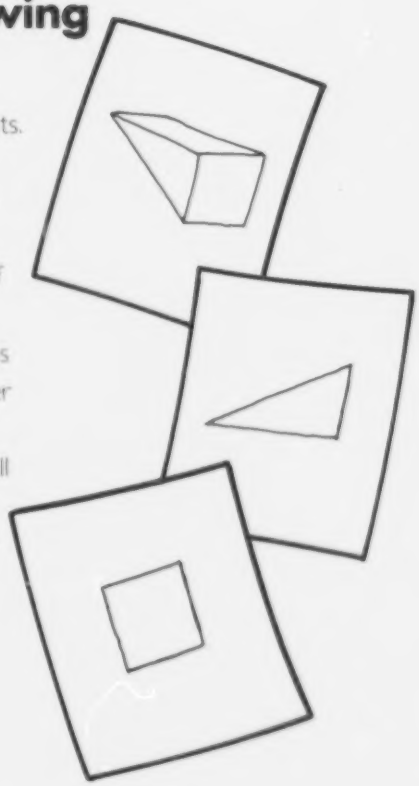
Tools of the Trade

An architect uses many tools to do his or her job. These tools include computer programs, drafting tools, and scales. Students can find out about these tools, learn how to use one of them, and demonstrate its use to the class.



Perspective Drawing

Place a geometric block in the center of a group of four students. Have students draw the block from their perspective and then write the name of the three-dimensional solid on the back of their drawing. Post one paper from a group. Can students guess what the object is? Show another paper and have students guess. Continue showing papers until all are shown. Then have students determine from which perspective each paper was drawn.



An Architect at Work

Students can read *What Can She Be? An Architect* or *I Can Be an Architect* to learn about an architect's job. Have students work in groups to brainstorm questions they might ask an architect during an interview. Students can practice interviewing each other. Then invite an architect to the classroom, or visit an architect in his or her office for a real-live interview.

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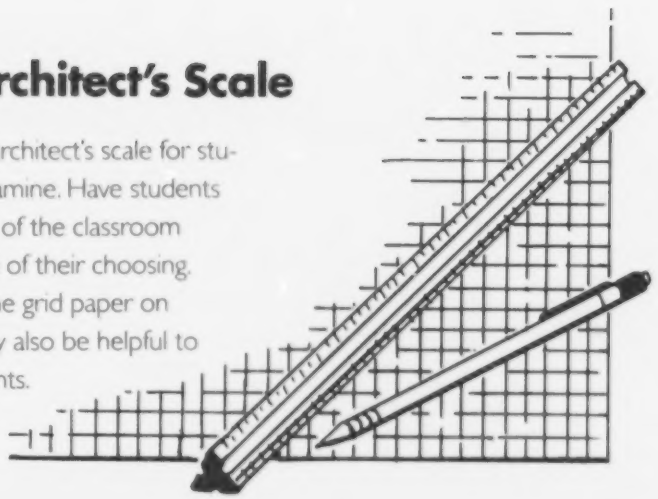
The Architect's Scale

Bring in an architect's scale for students to examine. Have students draw a plan of the classroom using a scale of their choosing. Copies of the grid paper on page 44 may also be helpful to some students.



Architects We Know

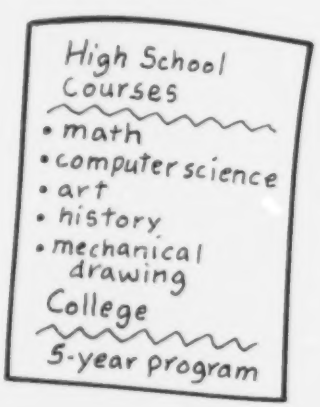
Have students research information about the lives of different architects. Students can write short biographies using the first person. They may want to illustrate their work with sketches of one or two of the buildings their architect designed. Collect the biographies and bind them into a book called *Architects We Know*.

Quoth He

Winston Churchill said, "We shape our buildings, and then our buildings shape us." What does the quote mean? Have students write the quote in their portfolios and jot down their thoughts about it. At the end of the theme, students can read the quote again and explain what they think it means.

A Career in Architecture

Students can find out about architecture education and training. What high school courses should you take if you're interested in a career in architecture? How many years of college are needed to complete a bachelor's degree in architecture? What are some schools of architecture and where are they located? Students can write to the American Institute of Architects (AIA) in Washington, D.C., for more information.



WORD BANK

blueprints

ON THE BOOKSHELF

What Can She Be? An Architect
by Gloria Goldreich and Esther Goldreich

I Can Be an Architect
by Susan Clinton

Students may enjoy reading about the lives of these three American architects.

Julia Morgan
by Cary James
This is a biography of Julia Morgan, the first woman in California to receive her architect's license and the architect of the famous Hearst Castle.

Frank Lloyd Wright
by Charlotte Willard
This is the fascinating life story of one of the world's most controversial architects.

The Will and the Way
by Karen E. Hudson
This unique biography takes a look at the life of Paul R. Williams, the first African-American member and Fellow of the American Institute of Architects.

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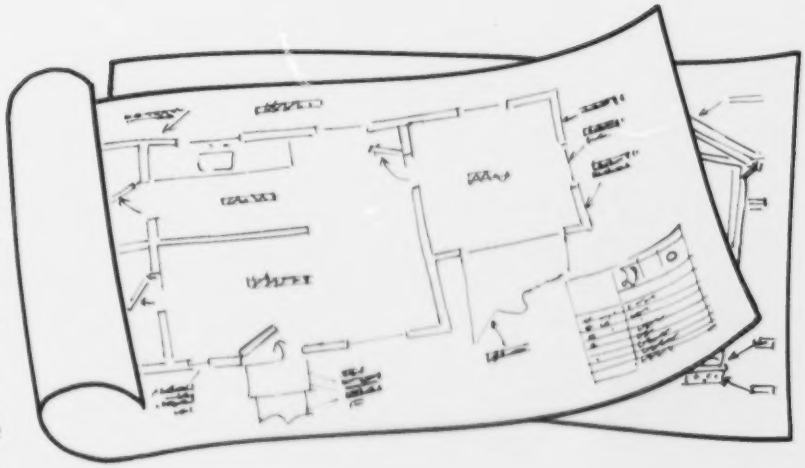
On the Construction Site

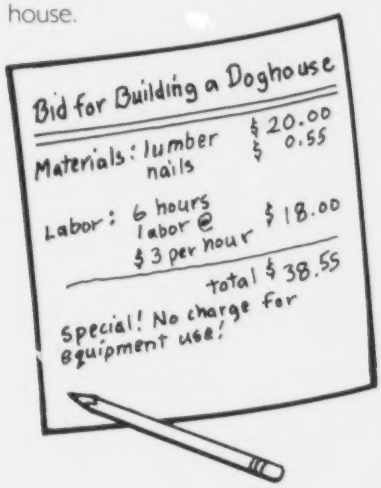
Blueprints



Blueprints are architect's plans for buildings. Obtain sets of blueprints from your city hall, the library, or an architect's office for students to study. Have students look at the plans. How are the doors shown? stairs? walls? windows? What is the scale? Students can make a legend showing the different symbols and what they mean.

Contractor Bids

Architects get bids from contractors for work on projects. Each bid specifies the cost of materials and the cost of labor. The architect evaluates each bid and then chooses the one most appropriate for the job. Have students create a bid for a small project, such as a tree house, a bird house, or a doghouse.


Bid for Building a Doghouse
Materials: lumber $20.00
nails $ 0.55
Labor: 6 hours labor @ $3 per hour $18.00
total $38.55
Special! No charge for equipment use!

Tool Time

How have tools evolved over the years? Assign different time periods or civilizations to groups of students and have them research the different types of tools used. Students can pretend they are tool sales people and must make a sales presentation to a potential client (the class). Why would a client need the tool? How is the tool used? What does it look like? What materials is it made of? Who would use the tool?

Visit to a Construction Site

Is there a building under construction in your community? Plan a field trip to the site, so students can see the tools and materials being used. Architects visit sites frequently to make sure projects are running smoothly. Students can prepare a list of questions to ask ahead of time. You may wish to visit the site now and at the end of the theme to compare the changes that have occurred.

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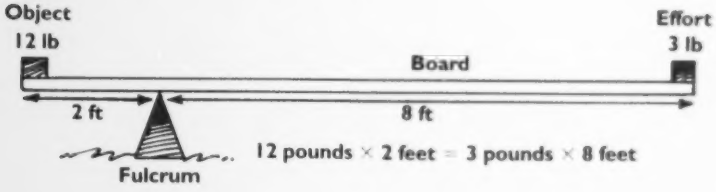
On-Site Personnel

Students can brainstorm a list of job titles of people who work on a construction site, such as plumbers, electricians, carpenters.

Then have students research one occupation and create a help-wanted advertisement seeking an experienced person.

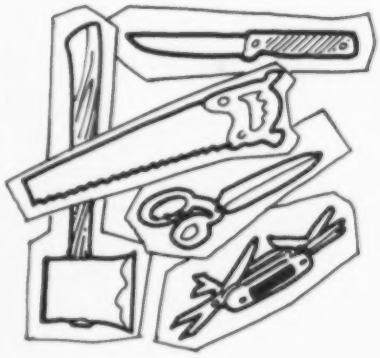
The Lever

Levers, such as crowbars and wheelbarrows, can be found on construction sites. A simple lever is a board that rests on a pivot, or fulcrum. The board is in balance when the weight of the object times its distance to the fulcrum is equal to the amount of weight, or effort, applied to the other end times its distance to the fulcrum. Students can prove that this formula works. Students can make a lever using a ruler and a triangular prism with a rectangular base as the fulcrum.



The Wedge

A wedge is a simple machine that has two or more sloping surfaces that taper either to a sharp edge or to a point. Knives, chisels, axes, and nails are all wedges. Using magazine and newspaper ads for hardware stores, students can create a collage of tools that are based on the wedge.



WORD BANK

bid

contractor

fulcrum

lever

wedge

RESEARCH IDEAS

- *Penny* is used to name standard nail lengths. Students can research how this term came to be.
- Lumber is sold in certain thicknesses and widths, but the actual board dimensions are different. Have students find out the actual dimensions of 1" × 3", 2" × 4", and 2" × 6" boards.

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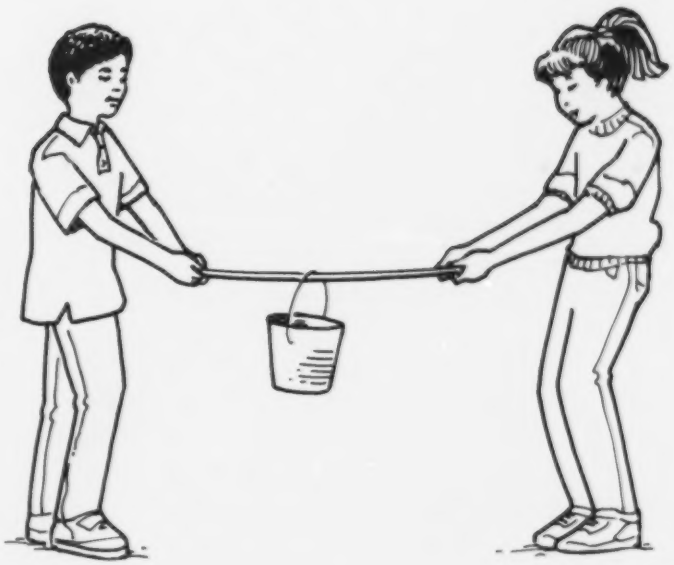
Building Materials

Properties of Materials

The materials architects include in their plans are important. They take into consideration properties such as strength, weight, flexibility, and texture. Give students same-size strips of cardboard, aluminum foil, and plastic (an old, clean shower curtain works well). Which strip is the strongest? Which is the most flexible? Which is the lightest? Students can first predict and then design experiments to test the different properties.



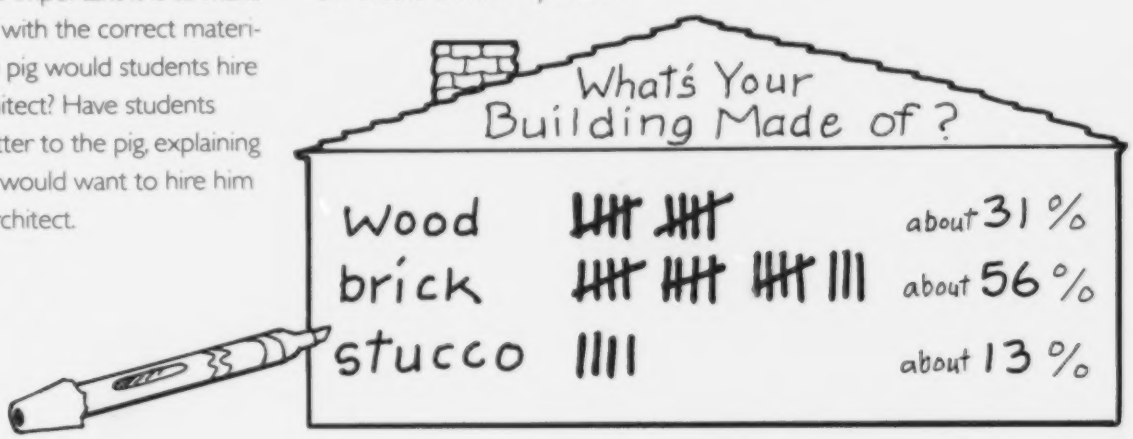
Which Pig?

The well-known story *The Three Little Pigs* and the Southwest version, *The Three Little Javelinas*, show how important it is to make a building with the correct materials. Which pig would students hire as an architect? Have students write a letter to the pig, explaining why they would want to hire him as their architect.

List of Materials

Students can brainstorm a list of building materials. What is the building where they live made of? Create a class tally chart.

Students can find what percent of students' homes are built of each type of material.



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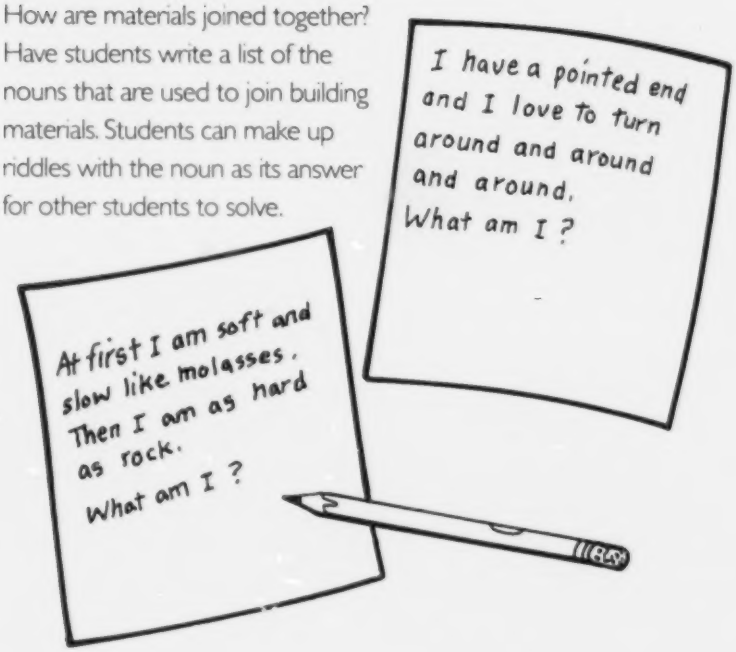
Putting It Together

How are materials joined together? Have students write a list of the nouns that are used to join building materials. Students can make up riddles with the noun as its answer for other students to solve.


I have a pointed end and I love to turn around and around and around, What am I ?
At first I am soft and slow like molasses. Then I am as hard as rock. What am I ?

The Walls Around Me

Have students look at the walls of the buildings in their community. What materials are the walls made out of? What patterns can students find? Have students make rubbings of the walls for their portfolios.

Symbols for Materials

On blueprints, architects use graphic standards to render different materials. Students can use the information on page 45 to see how architects indicate materials such as brick, glass, metal, wood, and marble on their working drawings. Have students make their own architectural drawings using these graphic standards.

ON THE BOOKSHELF

The Three Little Pigs
retold and illustrated by James Marshall

The Three Little Javelinas
by Susan Lowell

RESEARCH IDEA

- There are many different types of brick-wall patterns. Students can research the patterns and reproduce them or make up their own patterns using bricks made out of construction paper.

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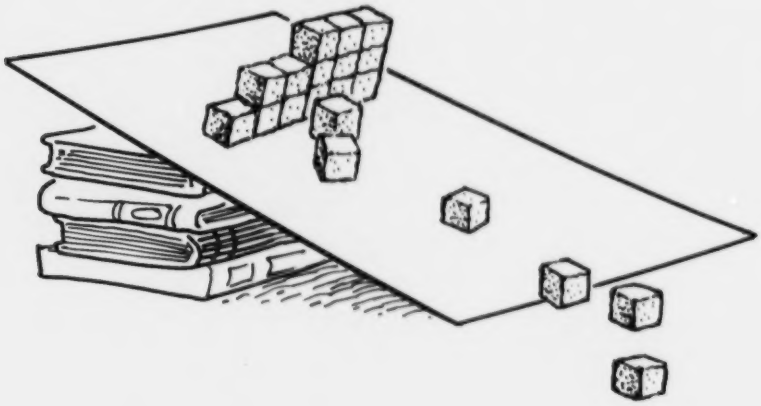
All About Structure

Be a Building!

Architects know about forces on buildings. *What It Feels Like to Be a Building* is a wonderful book that takes a look at the forces on a building and relates similar feelings to those made on the human body. Have students try some of the scenes in the book to feel the different forces at work.

How High?

Have students create a sloped surface by placing several books under one end of a stiff piece of cardboard. Give students sugar cubes and ask them to build a wall as high as they can. What happens? Have students design a way to build a wall without changing the slope of the cardboard. Students can share their different strategies.



From the Wall's Eye

The Crack in the Wall is a tale about a hermit's fight with a growing crack in his wall. Have students take turns reading aloud the story. Students can write the story from the wall's point of view. How did the crack start? Why did it grow? How did the wall feel at the end?

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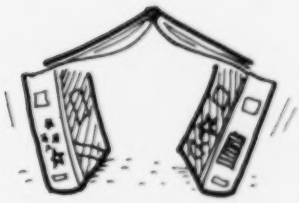
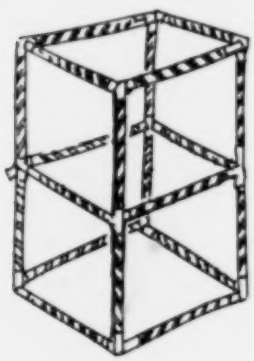
Roof Stability

First, have students place two cereal-box "walls" a small distance apart. Then, students should open a book in the middle and pretend that it is a roof. Can they balance the "roof" on top of the walls? Have students observe what happens and hypothesize why it happened. Students can try to fix the roof so it is more stable.



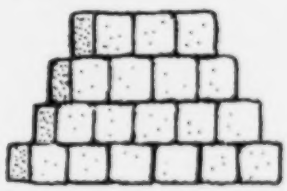
Straw Structures

Provide students with drinking straws and small paper clips. Students can connect the straws using the paper clips as joiners. How tall a structure can students build without it falling over? Have students compare their structures. Which ones used the most straws? the fewest? Which seem the sturdiest? How were the structures alike? different?



Tumbling Down

Using sugar cubes, have students build a brick wall so that each brick is lined up exactly on top of the one below. How strong is the wall? Can it topple over easily? Have students create a ramp perpendicular to their wall. Have them roll a toy car or small ball down the ramp and into their wall. How many bricks are still standing? Now have students design a sturdier wall. What is the configuration of the bricks now? How is the second wall different from the first? How many bricks were left standing? Why was the wall sturdier?



WORD BANK

bearing-wall construction

frame-and-skin construction

reinforced concrete

QUESTION BOX

What types of wall construction are there?

There are two basic types of wall construction: bearing-wall construction and frame-and-skin construction. In the bearing-wall construction, the walls carry the weight of the load. In the frame-and-skin construction, a framework carries the load and the walls and roof are protective "skins."

What is reinforced concrete?

Reinforced concrete is concrete embedded with metal rods. Concrete columns or walls will snap given enough force. Metal rods do not snap easily, but bend. By combining the two, you get a more stable material that handles both compression and tension.

ON THE BOOKSHELF

The Crack in the Wall
by George Mendoza

What It Feels Like to Be a Building
by Forrest Wilson

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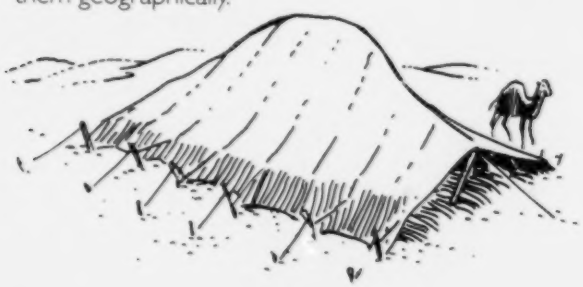
Environmental Influences

Shelters Around the World

The book *Shelters: From Tepee to Igloo* describes how people throughout history have found ways to use materials from their environment to build shelters. Students can research different shelters around the world and describe their forms, tell what they are made of, and compare them geographically.



The Sun's Rays

The angle of the sun's rays can affect the amount of roof overhang an architect may want. The architect must figure out the altitude of the midday sun during different times of the year. Have students figure out the altitude of the midday sun in their area.

Maximum midday altitude:
(90° + 23.5°) – (your latitude)

Minimum midday altitude:
(90° – 23.5°) – (your latitude)

At what time of year does the maximum midday altitude occur? the minimum midday altitude? Have students draw pictures showing the angle of the sun's rays at each time of the year.

The Walls Speak

The book *Talking Walls* introduces students to different cultures by exploring walls around the world. Students can locate each wall on a map and identify the natural materials found in that location. What would the wall say if it could talk? Have students write a dialog between the wall and a visitor.

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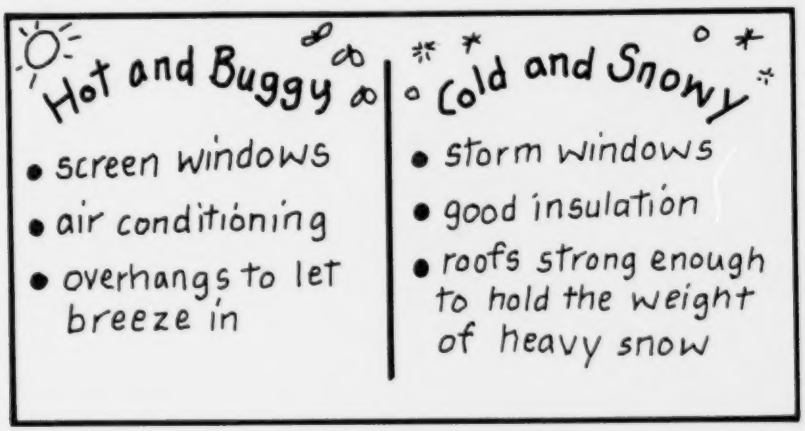
Climate

How does climate affect architectural design? Students can brainstorm a list of climatic conditions, such as hot and buggy or cold and snowy, and then list the kinds of things an architect would want to include in his or her design to accommodate the climate.

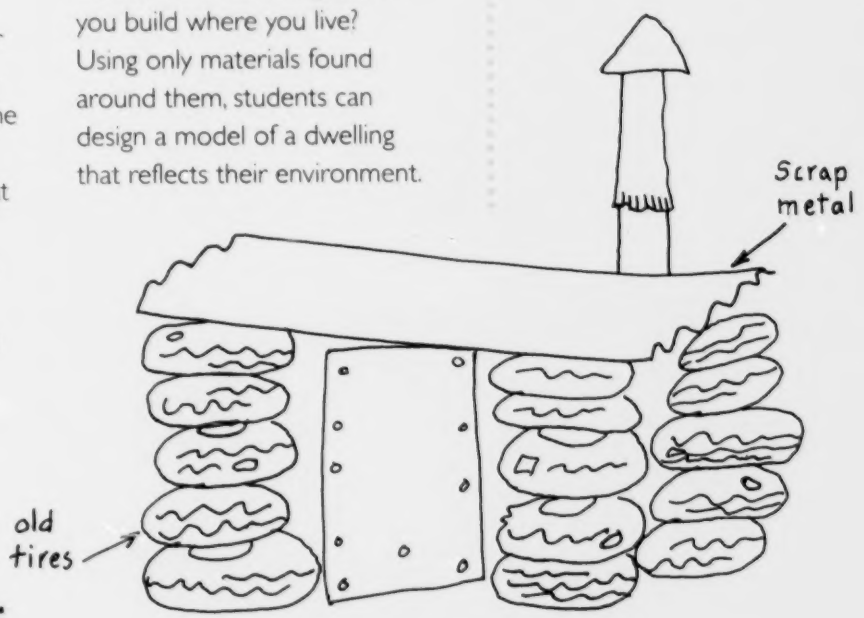

Hot and Buggy
• screen windows
• air conditioning
• overhangs to let breeze in
Cold and Snowy
• storm windows
• good insulation
• roofs strong enough to hold the weight of heavy snow

Environmental Stress

Earthquakes and special weather conditions, such as floods, tornadoes, and hurricanes, influence the shelters people build. Challenge students to create structures that are able to withstand strong winds. Use a fan to simulate the wind of a hurricane. The class can predict which structures will survive the best.

My Dwelling

What kind of dwelling would you build where you live? Using only materials found around them, students can design a model of a dwelling that reflects their environment.



ON THE BOOKSHELF

Shelters: From Tepee to Igloo
by Harvey Weiss

Talking Walls
by Margy Burns Knight

RESEARCH IDEA

- Students can compare Taliesen, Frank Lloyd Wright's home in Spring Green, Wisconsin, and Taliesen West, the home he built in Scottsdale, Arizona.

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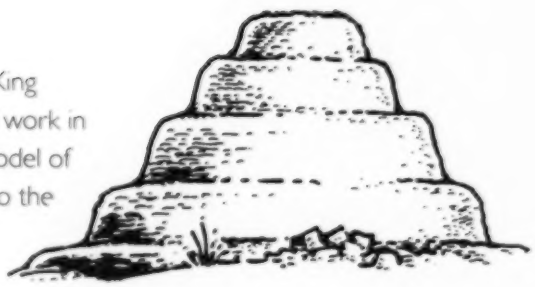
Egyptian Pyramids

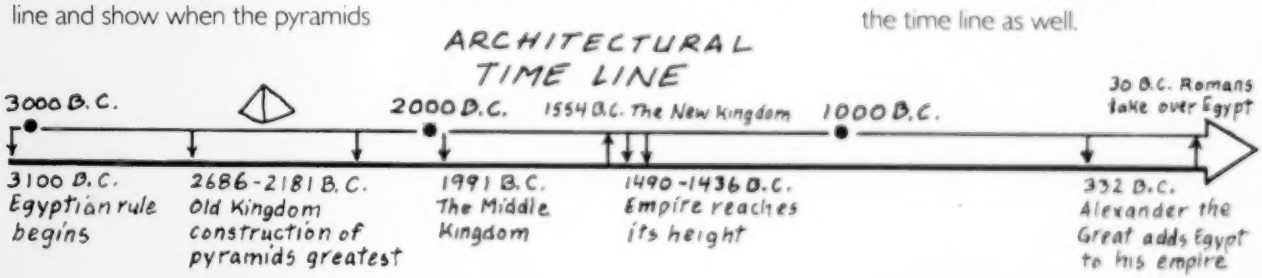
A Step Pyramid

About 2650 B.C., King Zoser asked Imhotep, his advisor and top architect, to design his tomb. The step pyramid he designed was the first large-scale stone structure in the world. Students can find out more about King Zoser's Step Pyramid and work in a group to make a clay model of it. How does it compare to the Great Pyramid at Giza?



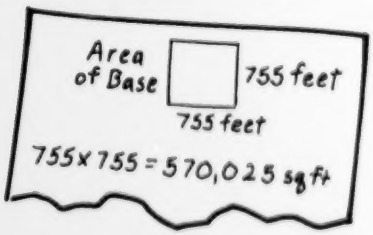
Architectural Time Line

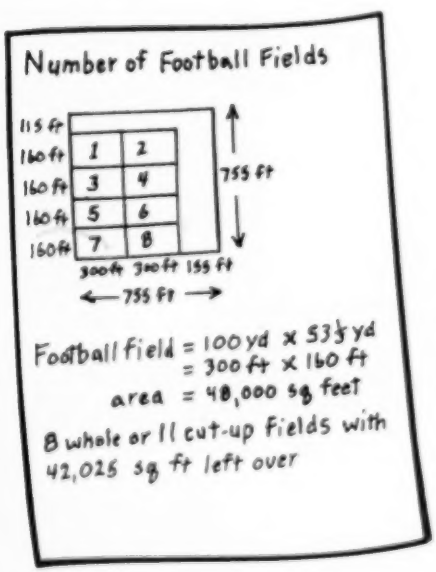
When did the Egyptians live? When were the pyramids built? Students can create a class time line and show when the pyramids were built. You may want to review with students the meaning and use of B.C. and A.D. Students can add to the time line as they learn about other styles of architecture. Have students illustrate the time line as well.


ARCHITECTURAL TIME LINE
3000 B.C.
2000 B.C.
1554 B.C. The New Kingdom
1000 B.C.
30 B.C. Romans take over Egypt
3100 B.C. Egyptian rule begins
2686-2181 B.C. Old Kingdom construction of pyramids greatest
1991 B.C. The Middle Kingdom
1490-1436 B.C. Empire reaches its height
332 B.C. Alexander the Great adds Egypt to his empire

How Big Is It?

How big an area does the base of the Great Pyramid at Giza cover? Students can look up the dimensions in an almanac or an encyclopedia and then compare its area to other known areas. For example, how many football fields would it take to cover the area of the base? Have students share their solutions.





The King's Treasures

Ancient Egyptians believed in life after death. A pyramid was a tomb built to preserve a king's or queen's body after death. The pyramid was filled with items for use in the afterlife. Students can make a list or draw pictures of objects they would want in their pyramid. Have students give reasons for their choices.

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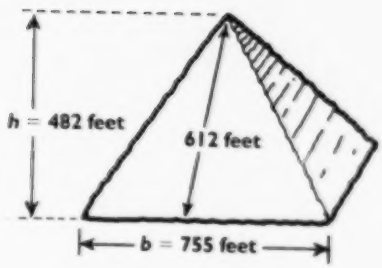
The Great Pyramid

What does the Great Pyramid of Giza look like? Students can research the measurements of the Great Pyramid and build a scale model out of cardboard. Students may wish to use the graph paper on page 44. (Note: It will be helpful if students have a calculator and know the formula for finding the hypotenuse of a right triangle: $a^2 + b^2 = c^2$. Or you can give students the measure of the hypotenuse if this concept is too advanced for your students.) Have students share their strategies.



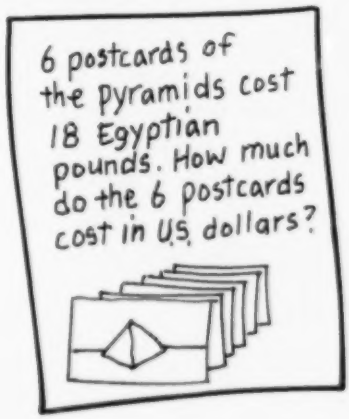
scale: $\frac{1}{4}$ inch = 50 feet

Where Shall It Be Built?

Students can pretend they are Egyptian architects and are building a pyramid for a king. Students can locate a site for the pyramid on the map on page 46. Have students write a letter to the king explaining why the location is good.

Egyptian Tourists

Egypt's giant pyramids attract tourists from all over the world. Students can pretend they are tourists in Giza. What currency do the Egyptians use? Have students find the current exchange rate in the newspaper. Students can make up math problems about buying architectural souvenirs using Egyptian currency. Have students share their problems.



DID YOU KNOW?

The Great Pyramid contains approximately 2,300,000 blocks.

The average weight of each block in the Great Pyramid is 2.5 tons.

ON THE BOOKSHELF

Here are some informative resources about pyramids:

Pyramid
by David Macaulay

An Egyptian Pyramid
by Jacqueline Morley, Mark Bergin, and John James

Pyramids
part of Kids Discover Series

RESEARCH IDEA

- Three huge pyramids at Giza rank as one of the Seven Wonders of the Ancient World. Students can find out about the other six wonders and make a poster of their findings.

MULTIMEDIA LIBRARY

Pyramid
by David Macaulay
This video gives a possible explanation of how the Egyptian's built the pyramids.

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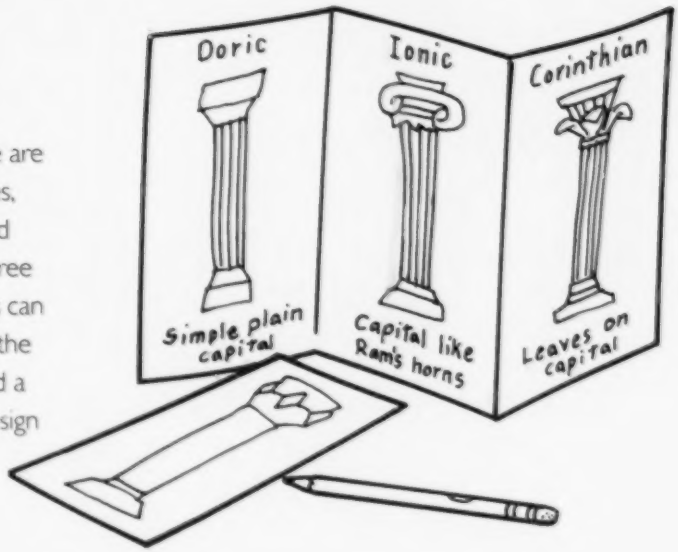
Classical Greek Order

The Columns

In Greek architecture, there are three different column styles, or "orders": Doric, Ionic, and Corinthian. How are the three columns different? Students can create brochures featuring the columns. Have students add a fourth column that they design and name themselves.



Architecture Olympics

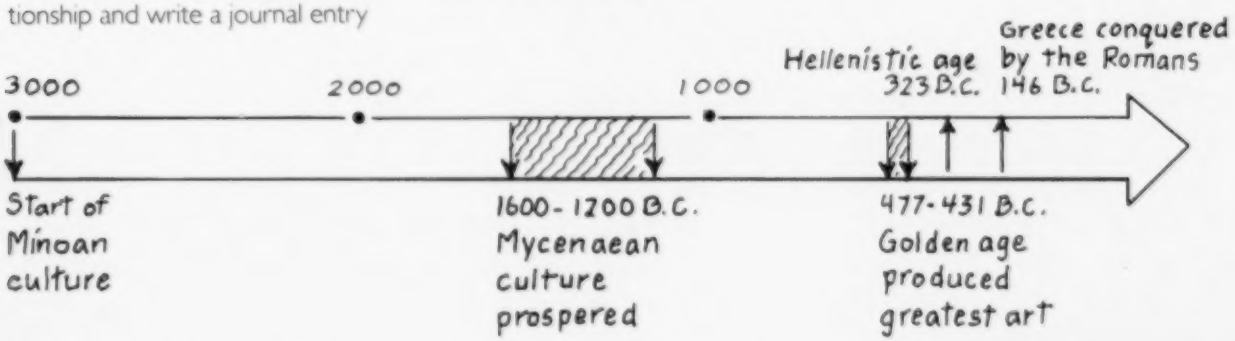
Besides temples, the Greeks built stadiums in which they held festivals to honor their gods. The Stadium of Olympia held 40,000 spectators to watch the Olympic Games, athletic events held to honor Zeus. Have students organize a mini-Olympics with events related to architecture, such as pounding a nail into a board the fastest, building the tallest structure out of aluminum cans, or naming the most tools in 30 seconds.

It's Greek to Me!

Students can discuss the meaning of the phrase "It's Greek to me!" Have them make lists of things they don't understand about architecture, building, or related subjects. Students can share their lists and compare them.

Architecture Reflects Life

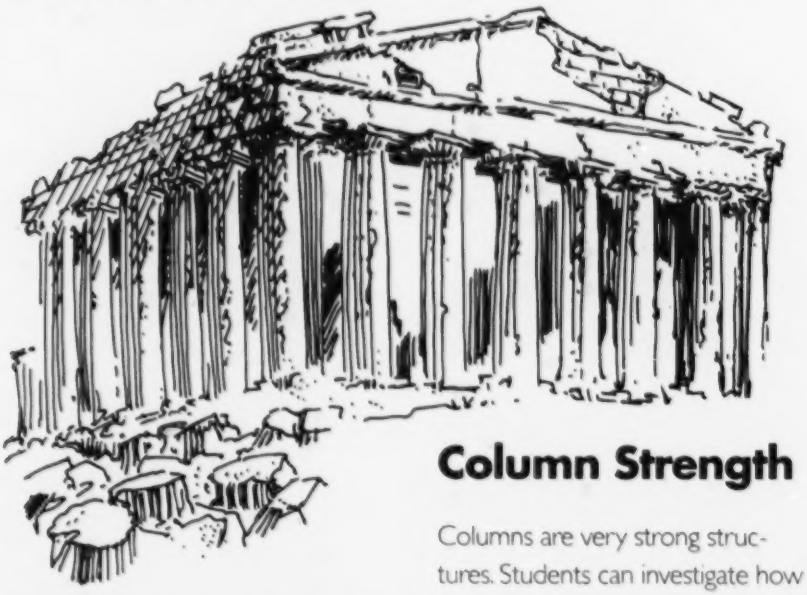
How is the ancient Greek lifestyle reflected in their architecture? Students can research this relationship and write a journal entry describing a Greek's beliefs. Then students can add the Greeks to their class time line.



The Parthenon

The principal type of classical Greek building was the temple. The Parthenon, the temple on the Acropolis in Athens, is the best known Greek temple. It is built of marble and has 46 Doric columns.

Take students on a column hunt in the community. Are there any buildings that have Greek-style architecture? Do any of the buildings have Doric columns?

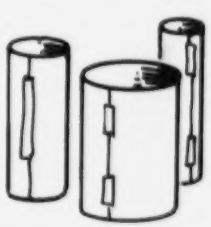


The Golden Ratio

The Greeks found a specific rectangle to be pleasing to the eye and used this shape in much of their art and architecture. This rectangle has a length to width ratio referred to as the "golden ratio." Students can find the golden ratio by using a ruler and a compass and following the directions on page 47. Then students can design a building façade, or front, using the golden ratio.

Column Strength

Columns are very strong structures. Students can investigate how columns hold things up. One sheet of paper cut into three pieces, then rolled and taped to form three cylinders can support a whole book! Have students explore different diameters and heights of columns. How small a diameter can students make the columns and still support the book's weight? How tall can the columns be?



WORD BANK

Corinthian

Doric

façade

golden ratio

Ionic

order

ON THE BOOKSHELF

The following books will give students information about ancient Greek lifestyle:

Ancient Greece
by Anne Pearson

A Greek Temple
by Fiona Macdonald and Mark Bergin

The Greek World
by Anton Powell

What Do We Know About the Greeks?
by Anne Pearson

The Greeks
by Susan Williams

RESEARCH IDEA

- The Greeks developed formulas for the various styles of temples. Students can find out about these formulas and write a formula for a temple.

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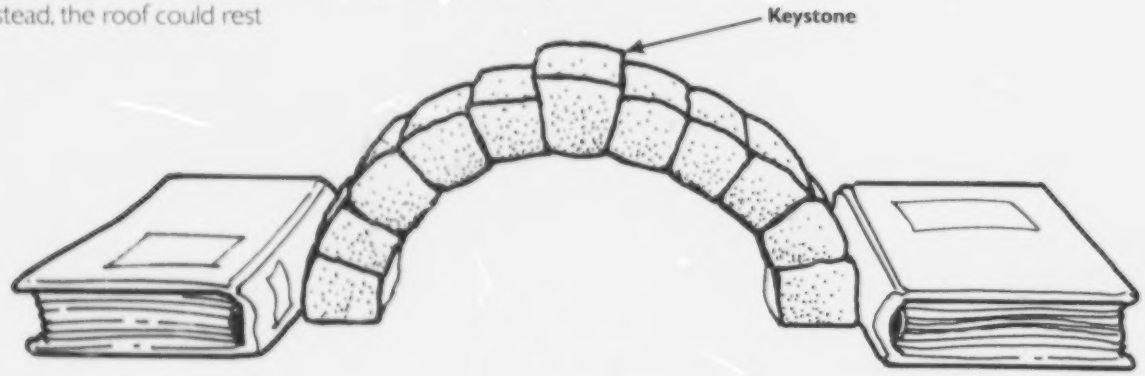
Roman Arch and Vault

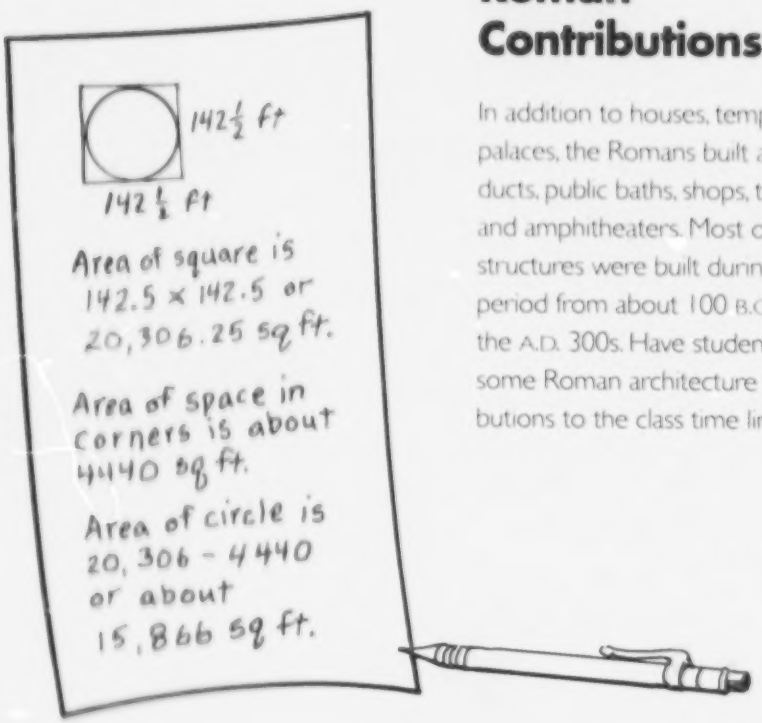
Arch Forces

The Romans were masters of the arch and vault. A vault is an arched ceiling. The use of the arch and vault reduced or eliminated the need for columns to support the roof. Instead, the roof could rest solely on the outer walls. Students can build their own arch by following the instructions on page 48. What forces are used to keep the stones in place?



The Dome

A dome is a kind of a vault. With the use of concrete, the Romans were able to build domed roofs. The Pantheon in Rome is an example of this. Both the diameter and height of the building are 142 feet. This gives visitors a sense of being in a spherical space. Have students mark off the floor area of the Pantheon on the playground. What strategies can students think of to find the area of the floor? Have groups of students work together to find the area. Then have students share their strategies.


142½ ft
142½ ft
Area of square is 142.5 × 142.5 or 20,306.25 sq ft.
Area of space in corners is about 4440 sq ft.
Area of circle is 20,306 - 4440 or about 15,866 sq ft.

Roman Contributions

In addition to houses, temples, and palaces, the Romans built aqueducts, public baths, shops, theaters, and amphitheaters. Most of these structures were built during the period from about 100 B.C. to the A.D. 300s. Have students add some Roman architecture contributions to the class time line.

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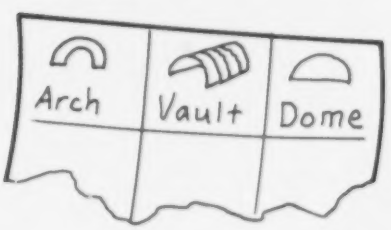
The Colosseum

The Colosseum was the largest of the Roman amphitheaters. It had four stories. There was room for 50,000 spectators. What kinds of events took place in the Colosseum? Students can draw a comic strip about their findings.

Looking for Roman Architecture

Students can walk around their neighborhoods. They can find and record the names of buildings that contain examples of an arch, a vault, and a dome.



Roman Gods and Goddesses

The Pantheon was built to honor all the Roman gods and goddesses. Students can find out the names of the Roman gods and goddesses, such as Jupiter, Juno, Diana, and Mars. Have students find out the comparable names for the Greek gods. Then read aloud a few of the Greek and Roman myths in *Classic Myths to Read Aloud*. Both Greeks and Romans wrote myths as explanations of events they couldn't understand. Have students write and illustrate a myth to explain something they don't understand.

WORD BANK

arch

diameter

dome

vault

ON THE BOOKSHELF

Classic Myths to Read Aloud
by William F. Russell

DID YOU KNOW?

The word *Colosseum* comes from the Latin *colosseus* meaning "colossal," which comes from *colossus*, or "something of gigantic size and proportions."

RESEARCH IDEAS

- Have students investigate whether they can build an arch with more or less curvature than the semicircular arch.
- Romans invented concrete. Students can find out what they made it out of and how it compares to the concrete we use today.

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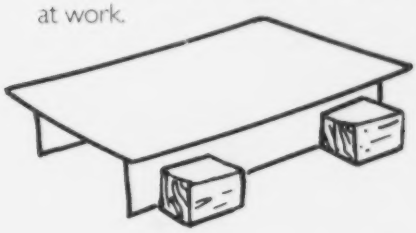
Medieval Castles and Cathedrals

Take a Trip to a Castle

Students can read about castles in books and in tourist information. They can make a tourist brochure about one of the castles describing what a visitor might see there.

Flying Buttresses

The roof of a gothic cathedral was made of stone. External flying buttresses helped the walls to support the weight of the roof. A flying buttress was a narrow, graceful support shaped like an arch. Have students use three pieces of cardboard to make a simple building with two walls and a flat roof. Students can put weights on the roof. How much weight can it take before collapsing? Then have students use wooden blocks to support the exterior walls. How much weight can the roof support now? Students can write up their conclusions about what forces are at work.



In the Middle

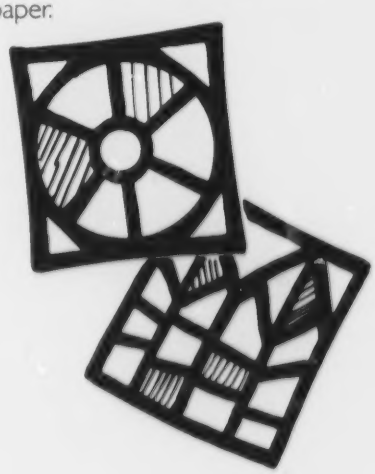
Medieval architecture refers to structures built in Europe during the Middle Ages. This historical period lasted from the A.D. 400s to the 1500s. Students can add the architectural contributions during this time span to their time line.

A-maze-ing Area

Cathedral floors were sometimes different-colored marble mazes. It was believed that finding one's way to the center of the maze was considered worthy of God's blessing. Have students design a circular maze. Can other students find the way to the center?

Stained Glass Windows

Gothic cathedrals had beautiful stained glass windows. The circular rose windows depicted the petals of a flower opening towards the sun. Have students make stained glass windows out of colored cellophane and black construction paper.



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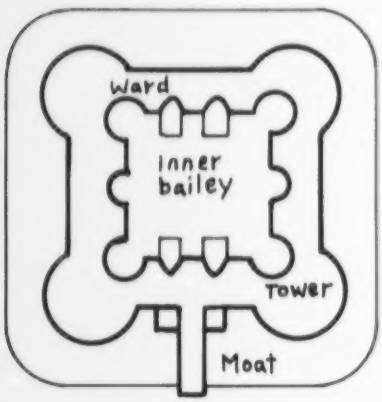
Gargoyles

A gargoyle is a decorated water-spout. Gargoyles are familiar parts of Gothic buildings. Masons usually carved part human and part animal figures to frighten away evil spirits. Have students think about something they fear. Then students can use clay to model gargoyles to frighten away their fears.

Build a Castle

Students can do research about parts of a castle and then build models using cardboard and paper tubes. What different geometric shapes can students identify in a castle? Students may also want to draw a floor plan of their castles.



Coats of Arms

It was difficult to tell one knight from another when they were dressed in armor, so knights began wearing personal symbols on their shields. Over time the symbols began to be known as "coats of arms," and noble families began putting them on everything, including carved above the castle gates. Students can design their own personal coats of arms.

Our Community Castle

The best place to build a castle was on top of a rocky cliff, a hill, or near a river or a lake. Get topographical maps for your area through your regional United States Geological Survey. (Check your telephone book under Government pages, Department of Interior.) Have students determine where the best place to build a castle is. Students can show the location and give a brief reason why it should be built there.

WORD BANK

flying buttress

gargoyle

rose windows

DID YOU KNOW?

Spiral staircases in castles were built clockwise so the enemy coming up had trouble striking with a weapon held in the right hand.

ON THE BOOKSHELF

Here are some informative books about castles and cathedrals:

Castle
by David Macaulay

Castle
by Christopher Gravett

Knights & Castles
Kids Discover Series

Cathedral
by David Macaulay

A Medieval Cathedral
by Fiona Macdonald and John James

MULTIMEDIA LIBRARY

Cathedral
by David Macaulay
This video explores how a cathedral was built.

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Chinese and Japanese Style

Chinese Symmetry

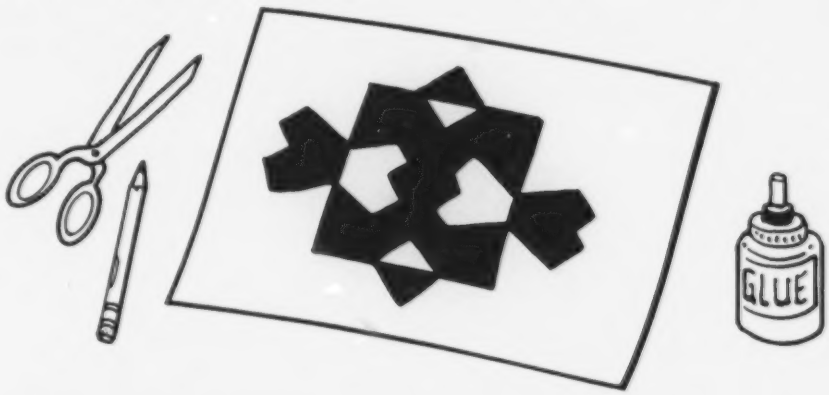
In Chinese architecture, the human world is marked off from the unknown on four sides by animal symbols: dragon (east), red phoenix (south), tiger (west), and snake (north). This four-sided square represents the human's territory, intellect, order, and house or city. A circle represents heaven. Using this philosophy of the world, Chinese architectural plans are primarily rectangular, with a southern orientation. As a result, Chinese architecture is very symmetrical. Have students find examples of architectural symmetry in their neighborhood. Where is each line of symmetry?

Japanese Asymmetry

In Japanese architecture, the focus is on both humans and nature. Buildings are planned to keep harmony with nature. Structures adapt to the random order of the landscape, creating an asymmetrical order. Challenge students to find examples of asymmetrical architecture in their neighborhood.

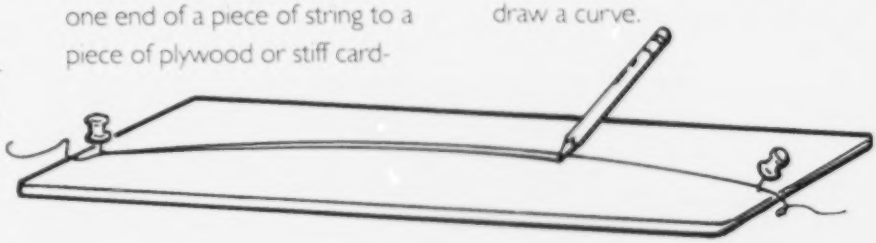
Notan

The solid part of a building is called positive space. Negative space is the area created by the solid part. The Japanese word *notan* explains positive and negative relationships. Students can create a notan design by first placing a square of dark-colored construction paper on top of a larger, white sheet of paper. Then, students cut shapes into the outside edges of the square, folding the shapes over to the outside, and pasting them down on the white paper. (The black parts of the design are the positive space; the white are the negative.)



Nawadarumi

Some Japanese draftsmen used rope or string to draw the curves on their plans. The nawadarumi, or slack rope, method enabled these draftsmen to show the graceful curves of roofs. Students can try this method. Have students tack one end of a piece of string to a piece of plywood or stiff cardboard. After pulling the string taut, students should create about a one-inch slack in the string and then tack down the other end. After placing a piece of paper under the string, students can move their pencils against the string to draw a curve.



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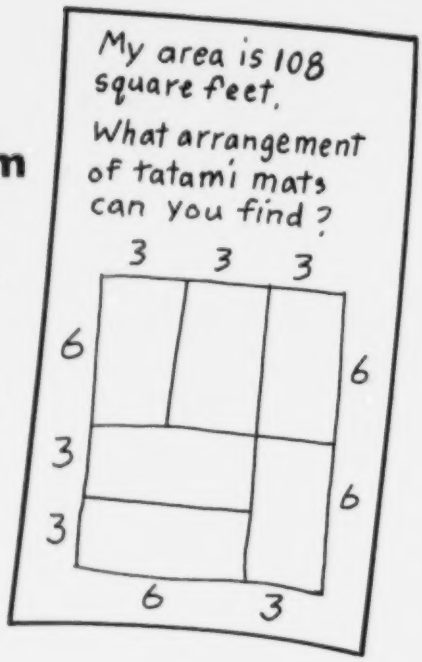
The Tatami System

A system of designing spaces that used to be widely used in Japan is the "tatami" system. A tatami is a straw mat that is used to cover the floor. The roughly 3' × 6' mat size was used as the proportion for all other elements of a structure. Students can design rooms using a certain number and arrangement of mats. They can figure out the area of the room and write a math problem for other students to solve.



Haiku

In my house this spring morning, there's nothing . . . that is, there is everything!

Sodo

Haiku is a Japanese three-line poem. The first and third lines have five syllables, and the second line has seven syllables. Have students discuss what this poem means to them. What does "there's nothing . . . there is everything!" mean? Students can write and illustrate their own haiku, perhaps about a style of architecture.

Pagoda

What's a pagoda? A pagoda is a type of tower commonly associated with Buddhist temples. In China, most pagodas have 8 sides and an uneven number of stories, usually 3 to 15. Students can find pictures of pagodas and build architectural models of them out of recycled materials.

WORD BANK

haiku

nawadarumi

negative space

notan

pagoda

positive space

tatami

RESEARCH IDEA

- The Great Wall of China is the longest structure ever built. Have students research its history. How long is it? Why was it built?

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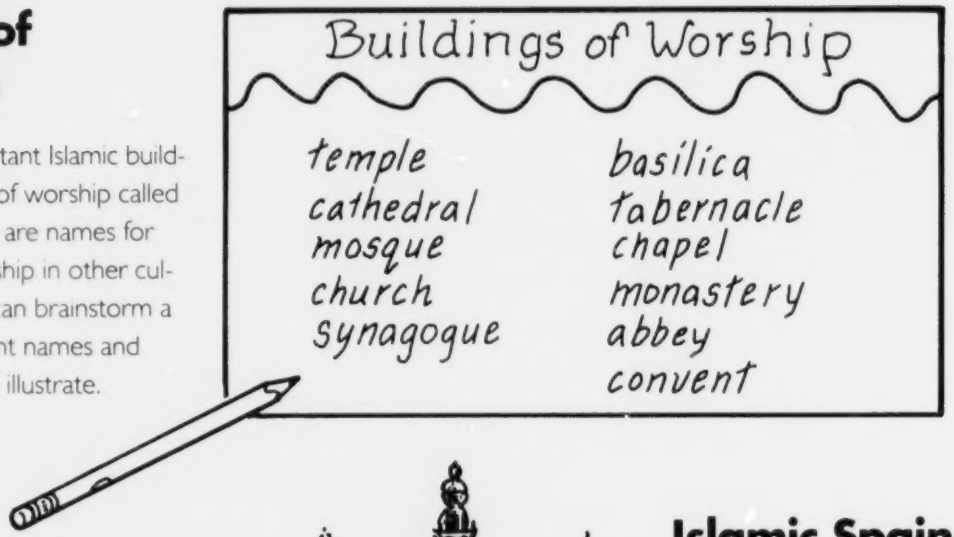
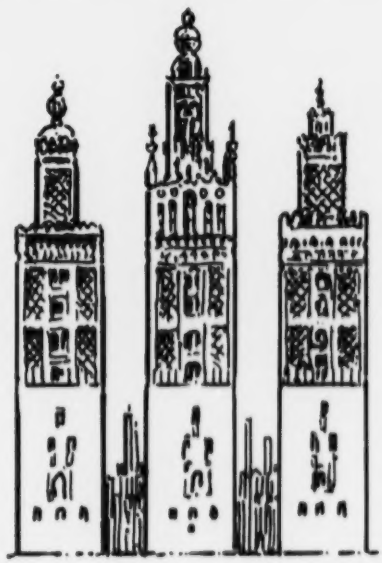
Islamic Architecture

Houses of Worship

The most important Islamic building is the house of worship called a mosque. What are names for buildings of worship in other cultures? Students can brainstorm a list of the different names and then pick one to illustrate.



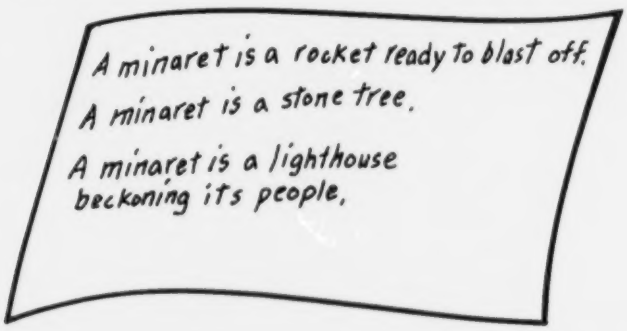


Islamic Spain

The Arab conquest of Spain began in 711 and lasted until 1492. You can still visit The Alhambra in Granada, the Giralda minaret in Seville, and the Great Mosque of Cordoba. Students can find out about these and other examples of Islamic architecture in Spain and write a travel article about a visit to one of these Spanish cities.

Minarets on Mosques

A distinguishing feature of a mosque is the minaret. A minaret is a tall, slender tower that has one or more balconies from which the muezzin, or crier, summoned worshipers to daily prayer. Have students use metaphors to describe a minaret.



Water's Reflection

Persian art and architecture show a reverence for water. The color blue was the favorite Persian color. Why is water so important in Islamic cultures? Students can research the location and climate of Islamic countries in search of an answer.

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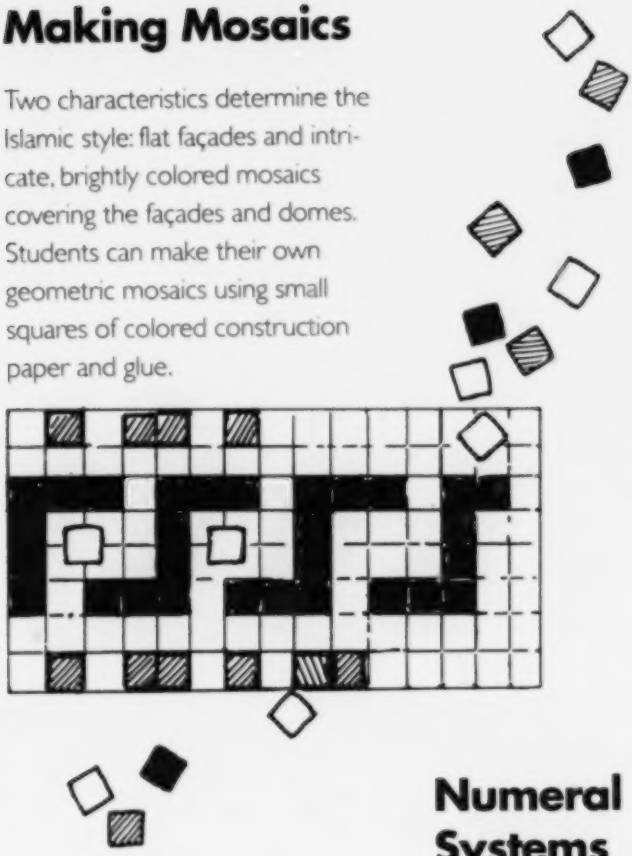
Making Mosaics

Two characteristics determine the Islamic style: flat façades and intricate, brightly colored mosaics covering the façades and domes. Students can make their own geometric mosaics using small squares of colored construction paper and glue.



Mud-Brick Houses

The word for mud brick in Arabic is *ad-dobe*. The Arabs took this word and style of architecture to Spain. In Spain, the word for mud-brick architecture became *adobe*. In the Arab world, adobe houses have been built in almost every shape. Students can build a model of a mud-brick house by following the directions on page 49.

Numeral Systems

Our numeral system was invented by the Hindus and brought to Europe by the Arabs. That's why it's called the Hindu-Arabic numeral system. Students can research other numeral systems, such as Roman, Mayan, and Egyptian, and explain how they work. Have students write mystery facts about architecture using numbers in another numeral system. Students can try to solve each other's mystery facts.

WORD BANK

adobe

minaret

mosaic

mosque

muezzin

ON THE BOOKSHELF

Students may enjoy reading these well-known stories:

Aladdin and the Enchanted Lamp
as told by Marianna Mayer and illustrated by Gerald McDermott

Tales from the Arabian Nights
retold from the original Arabic by N.J. Dawood and illustrated by Ed Young

RESEARCH IDEAS

- The Taj Mahal is the most famous example of Islamic architecture. Students can research why it was built and where it is located.
- Students can find out where *algebra* comes from and what it means.

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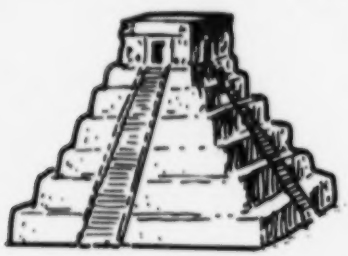
Pre-Columbian Architecture

Early Central and South American Architecture

The architecture preceding the sixteenth century in Central and South America reflected the beliefs of the Aztecs, the Mayans, and the Incas. Students can research and identify on a world map where these civilizations were. When did they rule? Have students add these civilizations to their class time line.

Houses of the Gods

Both the Aztecs and the Mayans believed that their temples were the houses of the gods. The top of the temple was modeled after ordinary native houses—rectangular shapes with one door—but the temple was built on a pyramid, giving it height and status. El Castillo in the Toltec-Mayan city of Chichén Itzá is a temple to Kikulcán (or the plumed serpent god Quetzalcoatl). Students can construct a temple-pyramid with the temple modeled after the building in which they live.

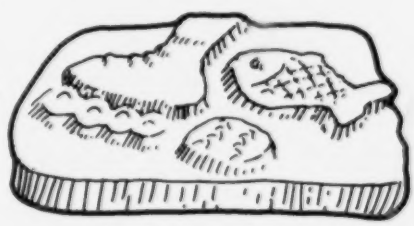


Tenochtitlán

The capital of the Aztecs was Tenochtitlán, a city built on an island in Lake Texcoco. The city was destroyed by Cortés and his army in 1521. It is believed that many of the walls of the temples and buildings were adorned with frescoes and bas-reliefs, depicting religious symbols. Students can make a bas-relief—a sculptural relief that slightly projects from the surrounding surface—using modeling clay. Their bas-relief can depict symbols of their hobbies or interests.

Machu Picchu

This Inca fortress is located about 8,530 feet above sea level on the eastern slope of the Andean mountain range in Peru. It remained hidden after the fall of the Inca empire in 1532 until archaeologist Hiram Bingham discovered it in 1911. The city's original name is unknown. Students can find out what *Machu Picchu* means and why it was the name given to the Inca fortress. What would students name the fortress? Have students think up other names.



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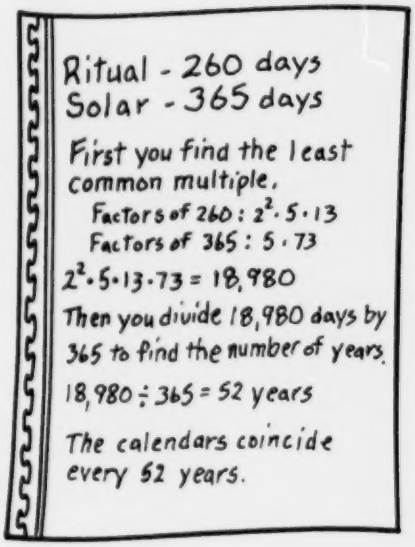
Aztec Calendar

The Aztecs had two calendar systems: a ritual calendar that was 260 days long and a solar calendar that was 365 days long. When these two calendars coincided, the Aztecs believed the world had begun again, and they celebrated the new beginning with a New Fire Ceremony. It is believed that the Aztecs rebuilt the temples and pyramids as a part of this renewal celebration. How many solar years passed before the calendars coincided? Students can figure out how many years there were between celebrations.


Ritual - 260 days
Solar - 365 days
First you find the least common multiple.
Factors of 260: $2^2 \cdot 5 \cdot 13$
Factors of 365: $5 \cdot 73$
$2^2 \cdot 5 \cdot 13 \cdot 73 = 18,980$
Then you divide 18,980 days by 365 to find the number of years.
$18,980 \div 365 = 52$ years
The calendars coincide every 52 years.

A Way of Life Ended

Divide the class into two groups: Aztecs and Conquistadors. How does an Aztec feel about the arrival of Cortés and his army? How does a Conquistador feel about conquering Tenochtitlán? Students can write a journal entry describing how they feel. Have students share their entries and discuss the different viewpoints.

Master Stone Masons

To build Machu Picchu, Inca men quarried granite stones and then placed them on rollers, then attached ropes to the rollers and pulled the stones to the building site. Stone cutters chipped at the rough surface of the rocks with stone tools, rubbing them smooth. Then they hoisted the stones with ropes up an earth ramp and fitted them exactly to surrounding stones. The fitting was so exact that even today a knife blade cannot be inserted between them. Have students compare these master stone masons with those of today. If possible, invite a mason to talk to students about his or her work.

ON THE BOOKSHELF

Students may enjoy reading these Central and South American legends:

Opossum and the Great Firemaker
written and adapted by Jan M. Mike

The Llama's Secret
written and adapted by Argentina Palacios

The Hummingbird King
written and adapted by Argentina Palacios

How Music Came to the World
retold by Hal Ober

The Dwarf-Wizard of Uxmal
by Susan Hand Shetterly and Robert Shetterly

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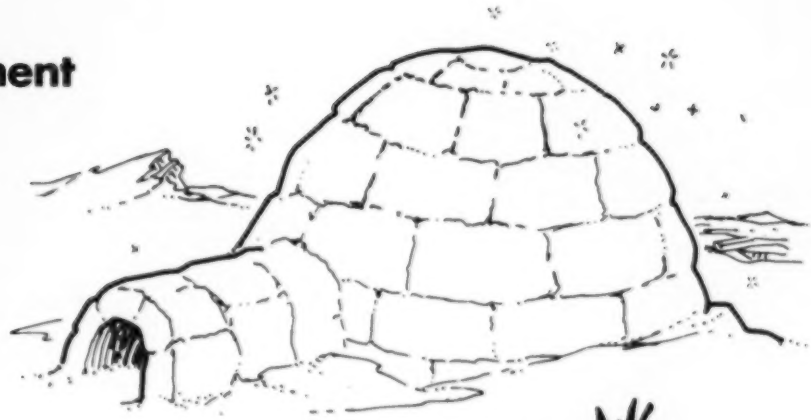
Native American Dwellings

Effects of Environment

Native Americans built many kinds of homes because they lived in different climates and had different building materials available to them. Students can research how environment and living style influenced the design of Native American dwellings. They can create short TV documentaries, using videotape equipment if available.



Tipi Shape

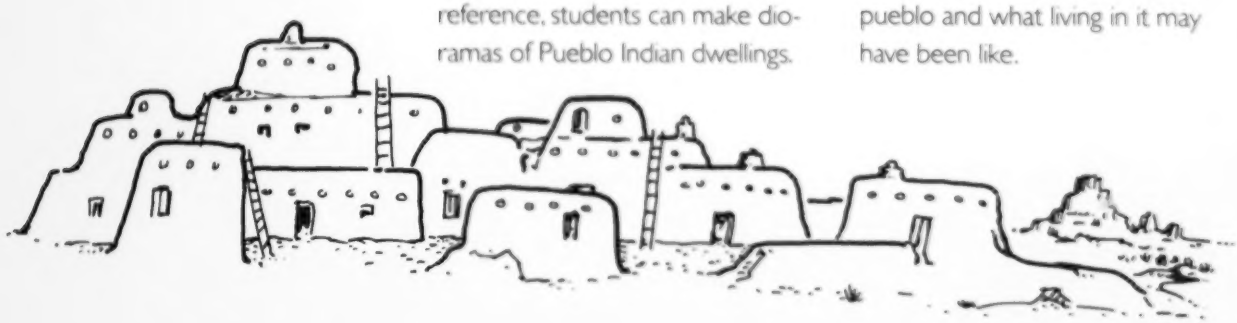
A tipi is the traditional home of Native American peoples of the Great Plains. Why is the cone shape of a tipi best for the heavy winds of the Great Plains?

Students can design an experiment to show why this shape is better than a cube, a rectangular prism, and so on.

Diorama Dwellings

Using a book such as *The Pueblo* by Charlotte and David Yue for reference, students can make dioramas of Pueblo Indian dwellings.

Students can describe the building materials used to construct a pueblo and what living in it may have been like.



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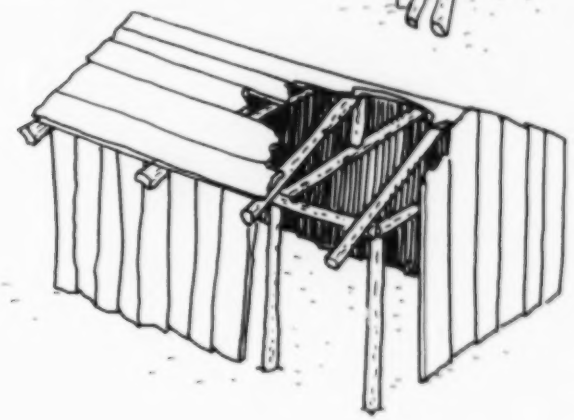
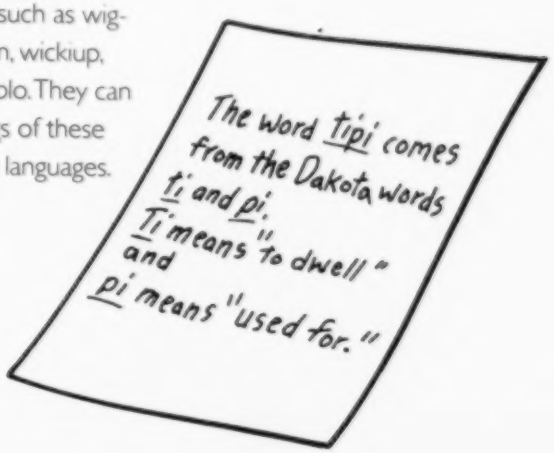
Build It Yourself

American Indian Habitats gives instructions for how to make models of several different Native American dwellings. Students may be interested in constructing one of the dwellings. Adult supervision is recommended.



What Does It Mean?

Students can brainstorm the names of different Native American dwellings, such as wigwam, tipi, igloo, hogan, wickiup, long house, and pueblo. They can find out the meanings of these words in their native languages.



DID YOU KNOW?

It took only 15 minutes for 2 women to put up a tipi.

ON THE BOOKSHELF

American Indian Habitats
by Nancy Simon and Evelyn Workson

The Pueblo
by Charlotte and David Yue

Students may be interested in reading these Native American tales and legends:

Back in the Beforetime: Tales of the California Indians
retold by Jane Louise Curry

Indian Tales
by Jaime de Angulo

And It Is Still That Way
as told by the Arizona Indian Children with notes by Byrd Baylor

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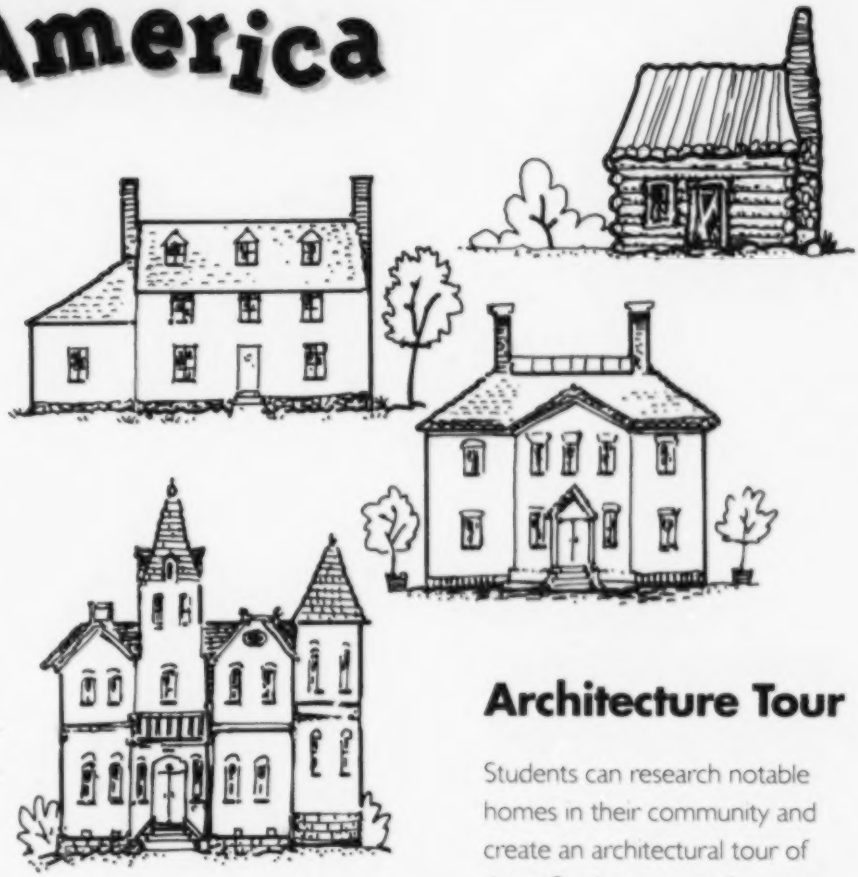
At Home in North America



Lots of Styles

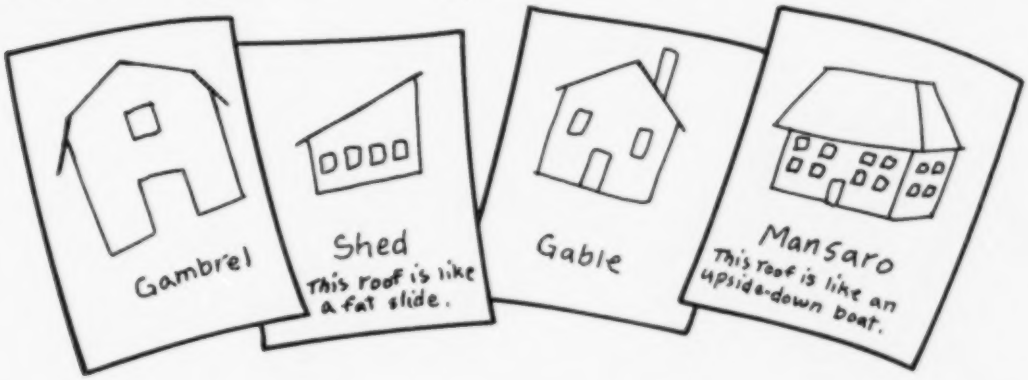
Have these books available: *What Kind of a House Is That?*, *To Grandfather's House We Go*, and *The House I Live In*. Talk about the different styles of American houses, and explain that many European-American settlers in North America brought with them the architectural style of their homelands. Students can choose styles, such as log cabin, ranch house, row house, Cape Cod, French colonial, Georgian, or Victorian, and point out on a map of the United States where they might find them.

Architecture Tour

Students can research notable homes in their community and create an architectural tour of them. Students can make a map indicating where each stop is and write an accompanying description of the landmark. Have students reproduce copies and give them to their local Chamber of Commerce.

Roof Styles

Have students compare the roofs in their neighborhood. What shapes are they? Students can draw sketches of roofs. Post students' drawings on a bulletin board. Have students write comparisons of their roofs to other objects.



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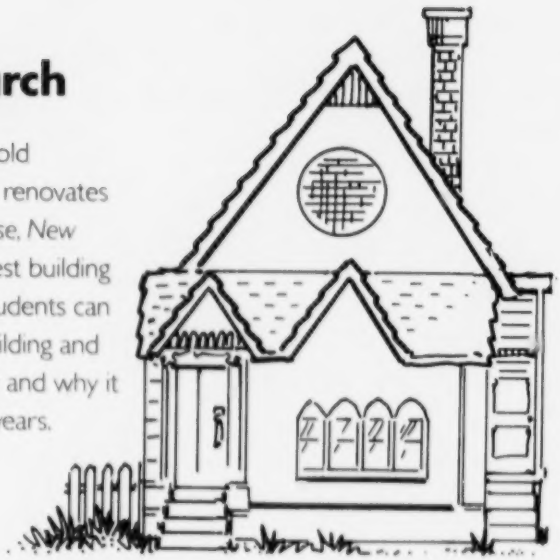
History Search

David's family buys an old Victorian mansion and renovates it in the book *Old House, New House*. What's the oldest building in your community? Students can research an historic building and write a report on how and why it has changed over the years.



My Home

What's the architectural style of the building where you live? Students can make sketches of their buildings. First, you may wish to have students read *Maria's House*, a touching story about a girl who struggles with whether to draw her real home—a tenement—or her dream house. What would students draw if they were Maria?

Hex Signs

Many Pennsylvania Dutch buildings are decorated with colorful designs called hex signs. Originally, hex signs were intended to protect against evil spirits, but now they are mainly used for decoration. Most hex signs are round and have geometric patterns. Students can create their own round, geometric designs. Have students identify the different geometric shapes.

DID YOU KNOW?

Swedish settlers first introduced the log cabin to America in the seventeenth century.

ON THE BOOKSHELF

What Kind of a House Is That?
by Harry Devlin

To Grandfather's House We Go
by Harry Devlin

The House I Live In
by Isadore Seltzer

Old House, New House
by Michael Gaughenbaugh and Herbert Camburn

Maria's House
by Jean Merrill

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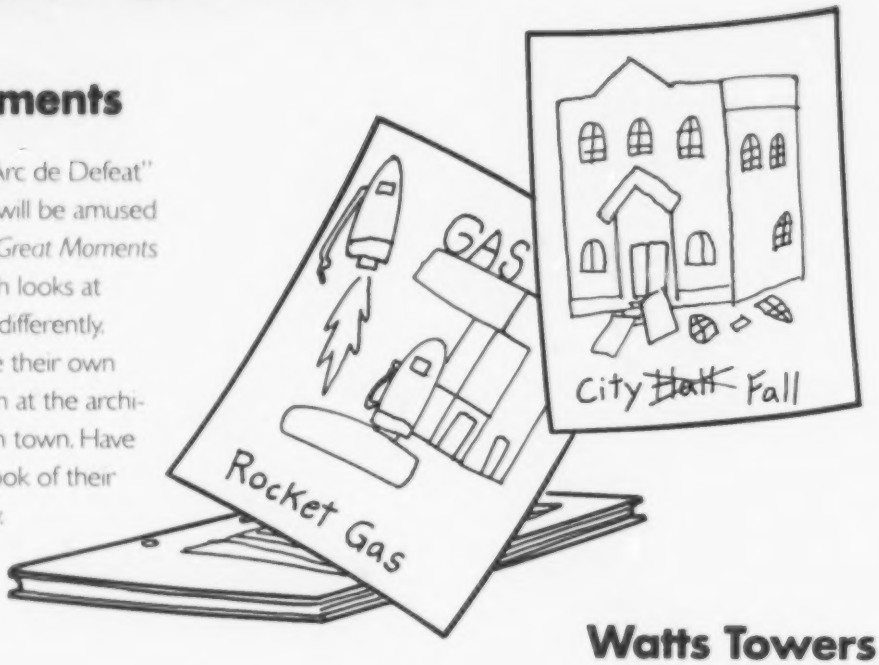
Looking at Modern Architecture

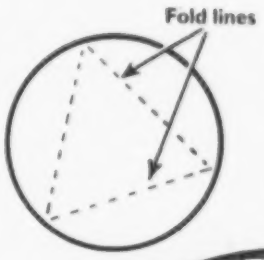
Great Moments

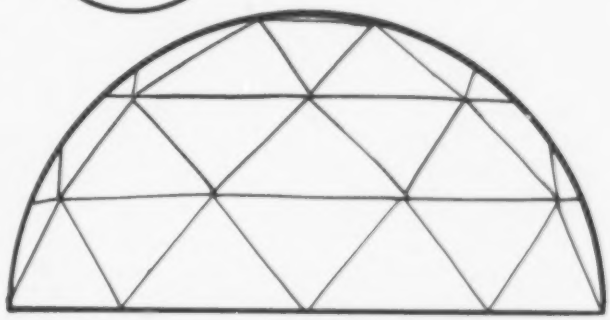
What does the "L'Arc de Defeat" look like? Students will be amused by the drawings in *Great Moments in Architecture*, which looks at architecture a little differently. Students can create their own drawings, poking fun at the architecture in their own town. Have students make a book of their drawings for display.



Geodesic Domes

Buckminster Fuller invented the geodesic dome principle. The surface of a geodesic dome is built up of many small triangular shapes. The size and position of these triangles is worked out mathematically. An icosahedron, a twenty-sided shape, is the geometrical form most frequently used in geodesic domes. Students can build an icosahedron out of stiff paper. First have students cut out 20 equal-sized circles. Students should fold the circles as shown to create equilateral triangles. Students can join the triangles by glueing the flaps together.





Watts Towers

A tower is an architectural structure whose height is much greater than its width or thickness. Students can read *Beautiful Junk: A Story of the Watts Towers*, about the Watts Towers in Los Angeles. They can construct or draw pictures of towers of their own and then write descriptions of what it would feel like to stand at the top of a tower.

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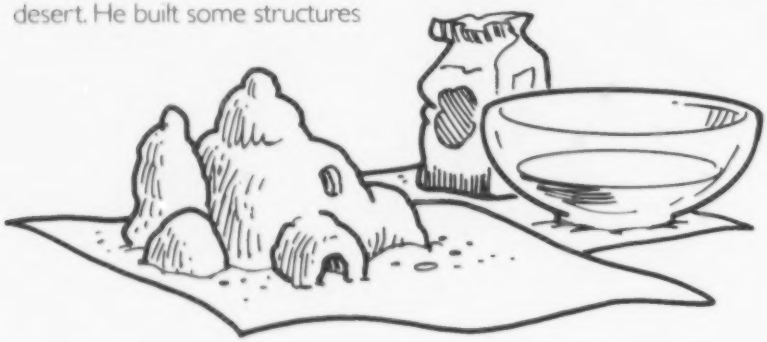
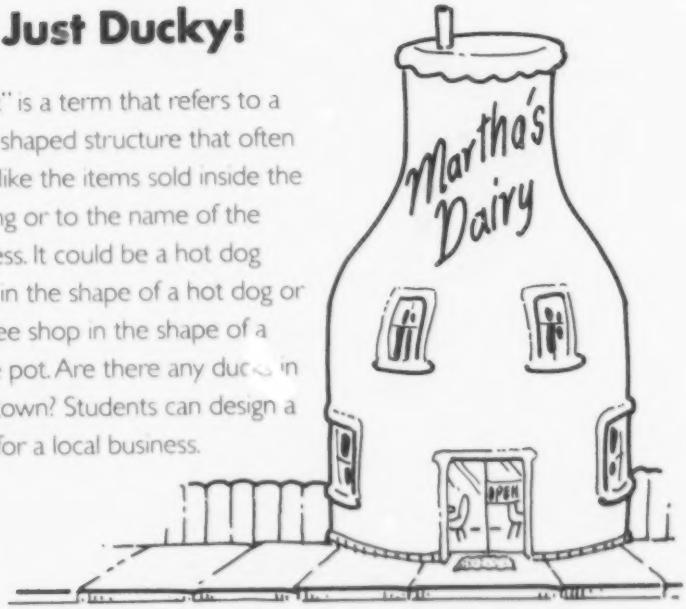
What's Arcology?

Arcology is a term architect Paolo Soleri made up by combining parts of the words *architecture* and *ecology*. Soleri is famous for his theories of preserving the environment. For many years, Soleri has been building Arcosanti, a dream city in the Arizona desert. He built some structures in Arcosanti by forming the earth into a desired shape, pouring concrete over it, and then removing the earth to expose the interior space. Students can experiment with this method of building by pouring plaster of Paris over shapes made out of wet sand.



It's Just Ducky!

"Duck" is a term that refers to a funny-shaped structure that often looks like the items sold inside the building or to the name of the business. It could be a hot dog stand in the shape of a hot dog or a coffee shop in the shape of a coffee pot. Are there any ducks in your town? Students can design a duck for a local business.



ON THE BOOKSHELF

Great Moments in Architecture
by David Macaulay

Beautiful Junk: A Story of the Watts Towers
by John Madian

More with Less: The Future World of Buckminster Fuller
by Nathan Aaseng
Students may be interested in learning more about Buckminster Fuller.

RESEARCH IDEAS

- Students can learn about the unusual architectural feature of the Museum Centre Pompidou in Paris.
- Have students find out about the unusual art nouveau style buildings designed by Antonio Gaudi, a Spanish architect.

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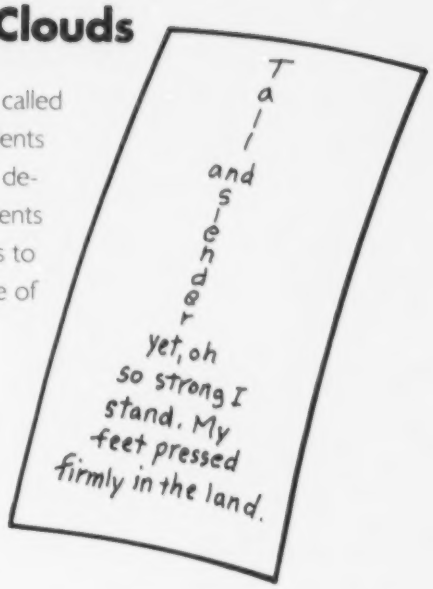
Touching the Sky

Scraping the Clouds

The first skyscrapers were called "cloudscrapers." Have students make a list of adjectives to describe these buildings. Students can pull words off their lists to create a poem in the shape of a skyscraper.

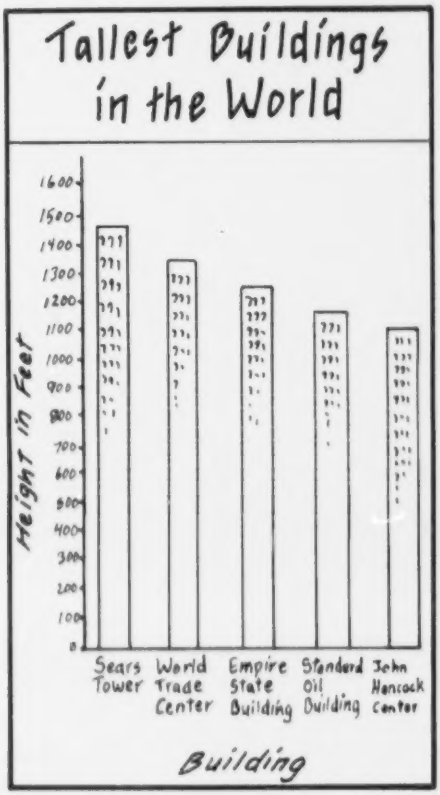


Skyscraper Architects

Students can find out what architects Mies van der Rohe, Phillip Johnson, I. M. Pei, Minoru Yamasaki, Cesar Pelli, and Helmut Jahn have in common—they are all architects of well-known skyscrapers. Have students draw a picture of a famous skyscraper and write a caption below the picture which includes information about the architect.

The Tallest Skyscrapers

Have students research the ten tallest buildings in the United States. Where are they located? How tall are they? Have students graphically display the heights of the top five buildings. Then students can figure out how many of them it would take to reach the height of the tallest building.



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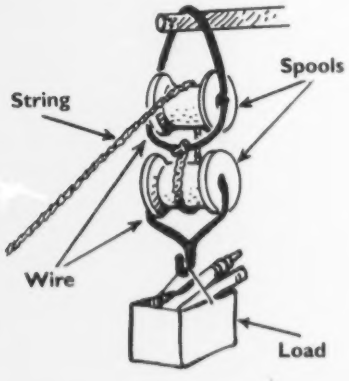
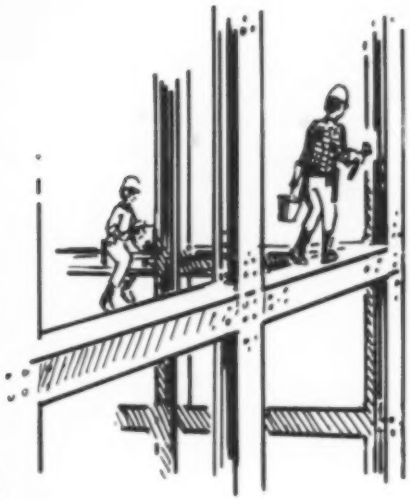
Iroquois Ironworkers

Iroquois ironworkers are known for their skill in high-steel work. They built most of the skyscrapers in New York City, working hundreds of feet above the sidewalk with nothing between them and the ground but a twelve-inch-wide piece of steel. Students can find out more about the job of high-steel workers. They can write why or why not this career would interest them.

Going Up!

Two inventions made the skyscraper possible: the structural steel frame and the elevator. How does an elevator work? The ancient Greek mathematician Archimedes invented a type of elevator before 230 B.C. It used ropes and pulleys. Students can make a model of a simple rope and pulley elevator using two spools, string, and wire.





A Solid Foundation

The weight of a building is called its "load." If a skyscraper's foundation cannot support the load, the building will sink into the ground. Students can simulate the load of a building to find which shape would disperse the building's weight most effectively. Give students some modeling clay, which will act as the ground. Then let students press each of the following objects, or "foundations," into the clay one at a time: a toothpick, a penny, the lid of a jar, and the penny resting in the jar lid. Which is the most difficult to press down? Based on their findings, students can design a foundation for a skyscraper. How does their design compare to actual foundations? Have students research the different types of foundations.

ON THE BOOKSHELF

The Big Book of Real Skyscrapers
by Gina Ingoglia

Skyscrapers
by Kids Discover Series

Skyscraper
by Tim Ostler

DID YOU KNOW?

It takes 70 seconds to ride an elevator up the Sears Tower. At the top, the Sears Tower can sway as much as 3 feet every few seconds.

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Building Bridges

Classifying Bridges

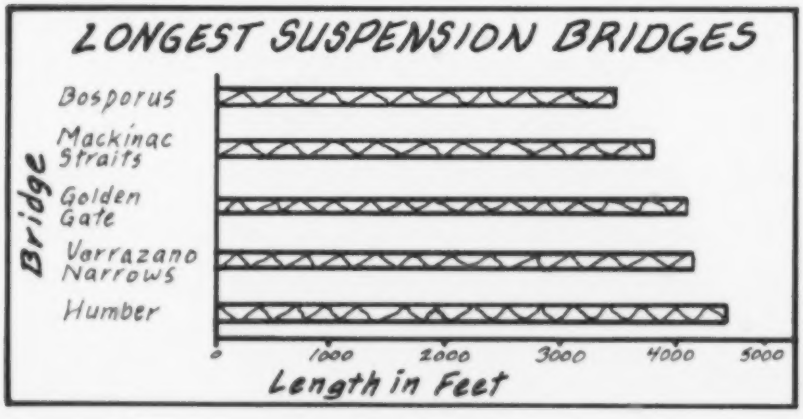
There are three types of bridges: beam, arch, and suspension. Have students find examples of each type. Students can also classify the types of bridges in their community. Have students clip pictures or sketch bridges for their portfolios.

Beam Bridges

A beam bridge is a horizontal beam supported on the ground or by piers at either end. Does the length of the beam affect the bridge support? Using two yardsticks, students place two desks 2 feet apart and lay one yardstick so that the same length is on each desk, then place the other yardstick next to the first one. Next, students use string to hang a small plastic pail from the center of one of the yardsticks. They should add weight to the pail until it sags 1 inch lower than the other yardstick. How much weight did students add? Now have them change the length of the span. Does it take the same amount of weight? Have students investigate different span lengths and graph their findings. What happens if students hold the yardstick on its edge and repeat the experiment?

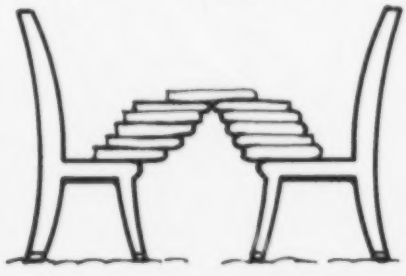
Suspension Bridges

Suspension bridges can span long distances. These bridges have a roadway that hangs from steel cables that are supported by two high towers. Students can display graphically the five longest suspension bridges in the world. Then have students figure out how many school buses parked end-to-end it would take to reach the end of the longest bridge.



Arch Bridges

The first arch bridges were corbeled, or stepped. Have students make a corbeled arch using stacks of books. Each book is extended a little farther toward the middle until the rows meet at the top. How far can students extend the books and still provide support? Why doesn't the arch fall in?



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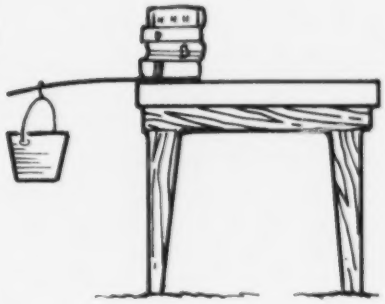
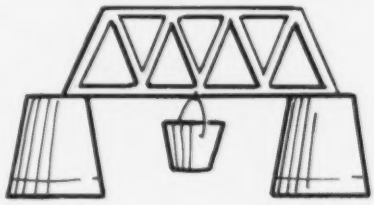
Cantilever Bridges

A cantilever bridge consists of two independent beams called cantilevers that extend from opposite banks of a waterway. Have students design an experiment to test how the length of a cantilevered beam affects its strength. Does the width and thickness also affect the strength?



Truss Bridges

A truss bridge is a type of beam bridge made up of trusses or triangles. Using straws and paper clips or tape, have students design a truss bridge. Whose bridge is the strongest? Students can test by hanging a pail with weights from the center.



Famous Bridges

What are some famous bridges in the world? Have students research bridges and find where they are located. Students can write the name of the bridge and a clue describing its location. Students can exchange riddles with other classmates.

A Linking Limerick

The limerick is a humorous five-line poem in which lines one, two, and five have three stressed syllables and rhyme, and lines three and four have two stressed syllables and rhyme. Have students write limericks about bridges. Students may wish to illustrate their limericks.

An architect, good Mr. Gaylord,
Built a school for the
town called Concord.
A mistake with the roof,
(what a terrible goof!)
So the children got wet when it poured.

WORD BANK

arched bridge

beam bridge

cantilever bridge

corbeled arch

suspension bridge

truss bridge

RESEARCH IDEA

- Students can investigate bridge failures that have occurred throughout history. What was the cause of the failure?

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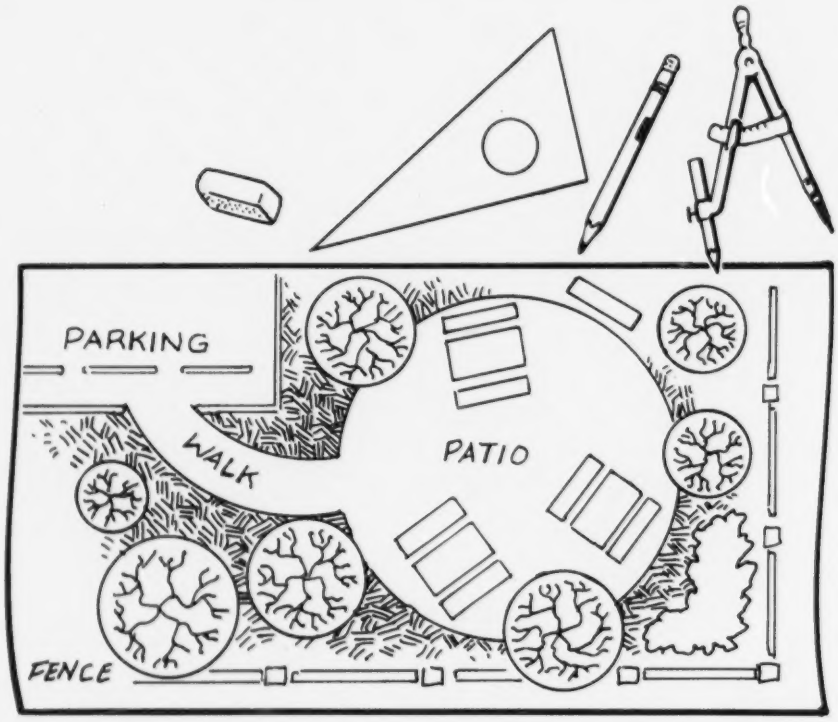
Outdoor Design

Our Site Plan

After land use has been determined, landscape architects prepare site development plans. They design walls, sitting places, fountains, fences, steps, pavement patterns, and planting arrangements. Are their vacant lots in your community? Is there an area in the school yard that could use sprucing up? Have students create a site development plan for the area. The grid paper on page 44 may be helpful to some students. Tell students to create a scale for their plan. Students may wish to write a letter telling why their plan should be implemented.



I Am a Landscape Architect

A landscape architect creates outdoor environments much as architects plan buildings. Students can read a biography about Frederick Law Olmsted, the first person to call himself a landscape architect. In the 1850's, the firm of Olmsted and Calvert Vaux designed New York City's Central Park. Students can name or draw pictures of structural things that make up, or can be found in, a large city park.

Soil Types

What type of soil is on the playground? Knowing the type of soil in a specific area helps landscape architects decide what to plant. Have students research and make a chart showing the differences between clay, sandy soils, and loam. Students can design an experiment to determine which type of soil they have in their back yard, in the school yard, and in other locations in the community. Which location has the best soil?

Property	Soil Type		
	Sand	Loam	Clay
Temperature	warms fast	warms medium	warms slowly
Drainage	excellent	good	poor
Size of Particles	large (can see with naked eye)	small (can see with microscope)	very small (can see with electron microscope)
Easily Eroded by Water	easy	medium	difficult
Capacity for Holding Water	low	medium	high

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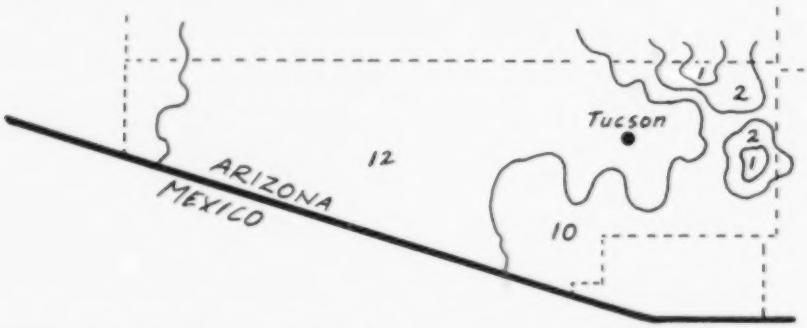
Climate Zones

Plants grow best in certain climates. Gardening books can tell students in which climate zones varieties of plants will grow successfully. Students can find and map the different climate zones for their state or local area. Students should give a brief description of the type of climate in each zone and pick out plants that would grow well.



10 High desert with 75-100 nights each year below 32° F. Annual rainfall averages 12 inches, half the amount falling in July and August.

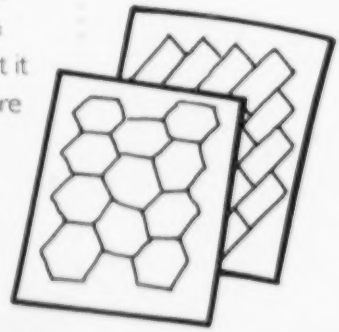
12 Intermediate desert with 22 nights each year below 32° F. Strong winds (25 - 40 mph) between March and May. Expect summer rains.

As the Garden Grows

Students will enjoy *The Secret Garden*—the story of a lonely, willful girl and how she finds friends, health, and happiness through a secret garden. Do students have a special place they go to? Have students describe what their own special place is like.

Patio Tessellations

Landscape architects often plan floors for patios using bricks or concrete blocks to create a design or pattern. Have students pick a shape and repeat it in a pattern with no spaces between so that it tessellates. Students can compare their patterns. Who used the same shape? How are the patterns the same? How are they different?



DID YOU KNOW?

There are micro climates in any yard that are affected by such things as altitude, slope of the ground, type of soil, and nearness of buildings or other solid structures.

Cold air travels downhill until it hits an obstacle.

ON THE BOOKSHELF

Frederick Law Olmstead
by Johanna Johnston

Sunset Garden Books
by the editors of *Sunset* books and *Sunset* magazine
These books are written by geographical area. Students will find a wealth of information for designing their own landscape.

The Secret Garden
by Frances Hodgson Burnett

MULTIMEDIA LIBRARY

The Secret Garden
Students can compare the book and the video, and tell which they like better and why.

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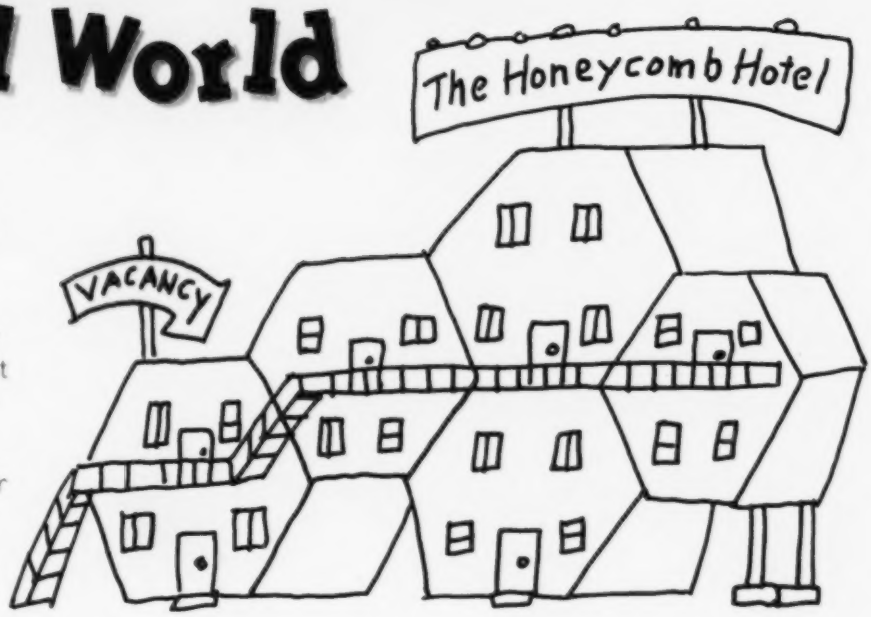
Architects in the Animal World



Art from Nature

Does a termite mound remind you of a skyscraper? Does a beehive make you think of apartment buildings? Do shingles resemble fish scales? Many architects use forms from nature to inspire their designs. Students can identify architectural elements in their neighborhood that resemble forms from nature. Then students can use a form from nature to design their own building.

Animal Analogies

What different types of animal homes are there? Students can write analogies to identify them: A house is to a person as a ____ is to a ____. Generate a class list that students can add to on an ongoing basis.

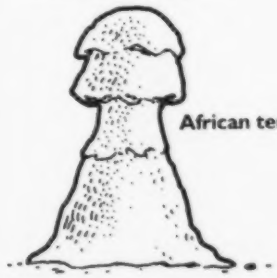
Analogies

A house is to a person as a _____ to a _____.

shell	crab
nest	bird
web	spider
den	fox
lodge	beaver
den	polar bear
warren	rabbit
burrow	prairie dog
hive	honeybee

A Different Point of View

How does a beaver build its lodge? How does a garden spider spin its web? How does a wasp make its paper nest? Students can pick an animal or insect and research how that animal or insect builds its house. Students can take the animal's or insect's point of view and write about the experience of building the house. Have students make a model of the animal's house to accompany their description.



African termite mound

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Why Animals Build

Animals build for many of the same reasons people do. Have the class brainstorm reasons why animals and people build. Are any of the reasons different?

Why People Build	Why Animals Build
• for safety	• to protect them from enemies
• to protect them from the weather	• to protect them from the weather
• for storage	• to store food
• to provide places for specific needs (such as schools, hospitals, and fire departments)	• to catch food
	• to raise young

Fictitious Animal Habitat

Give students the following information about a fictitious animal:

- It eats bugs that crawl on the ground.
- It lays 12 eggs.
- Its enemy is the cat.
- It is about 3 inches long, 1 inch wide, and 1 inch tall.
- It needs to drink water, but it doesn't like to get wet.

Have students give the animal a name, draw a picture of the animal, and create a life-size model of the animal's home. Students should state reasons why the home is appropriate for the animal.

Animal Houses Around Us

Go on a field trip to observe different animal and insect houses nearby. If an animal is in the process of building, come back several times to observe the changes that take place. Remind students to be careful not to disturb the animal or insect. Students can make sketches and then write captions explaining what they saw.

DID YOU KNOW?

In parts of southern Africa, the sociable weaverbirds build straw homes that stretch 15 feet across and hold as many as 125 pairs of birds.

Eastern tent caterpillars build silk tents on tree branches. The tents protect as many as 300 caterpillars from stinkbugs and other enemies. When the caterpillars are ready to develop into moths, they leave the tent.

African gray tree frogs use their hind legs to create a foamy mass about the size of a volleyball. Females lay about 150 eggs in this mass, which the males immediately fertilize.

ON THE BOOKSHELF

Both of these books are wonderful resources that explain how animals and insects build their homes.

Animal Architects
by National Geographic Society

Animal Architecture
by Jennifer Owings Dewey

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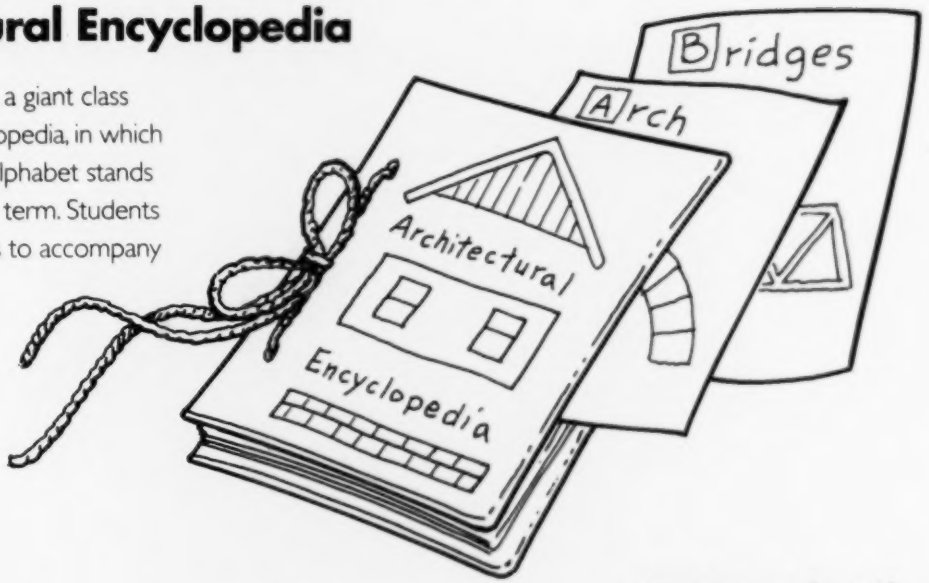
Final Presentation

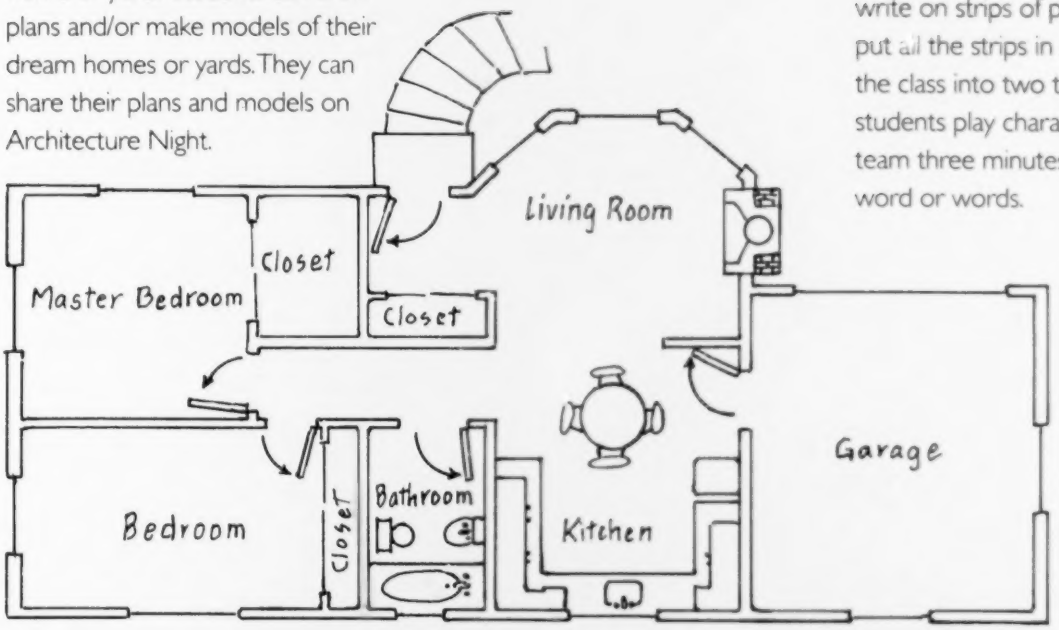
Architectural Encyclopedia

Students can make a giant class architecture encyclopedia, in which each letter of the alphabet stands for an architectural term. Students can use illustrations to accompany their definitions.



My Dream Home

What is your idea of a dream home or yard? Students can draw plans and/or make models of their dream homes or yards. They can share their plans and models on Architecture Night.



It Sounds Like . . .

What architectural terms, quotes, names of architects, or styles of architecture can students think of in two minutes? Have students write on strips of paper and then put all the strips in a bowl. Divide the class into two teams and have students play charades, giving each team three minutes to act out the word or words.

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Architecture Night

Invite family members to an Architecture Night to see students' portfolios and other class projects. Students can transform different areas of the room into a style or period of architecture. Students responsible for each area can build models of buildings, dress up in clothing, and make and serve food of that culture or period.

Onions and Orchids

Students can take photos of buildings in their neighborhood or community. On Architecture Night, awards can be given for the biggest eyesores and the best architecture.

Portfolio Review

Students can review their portfolios and pick five or six of their best pieces. Have students write a cover letter explaining why they picked the pieces they did. Students can present these "final" portfolios at the Architecture Night.

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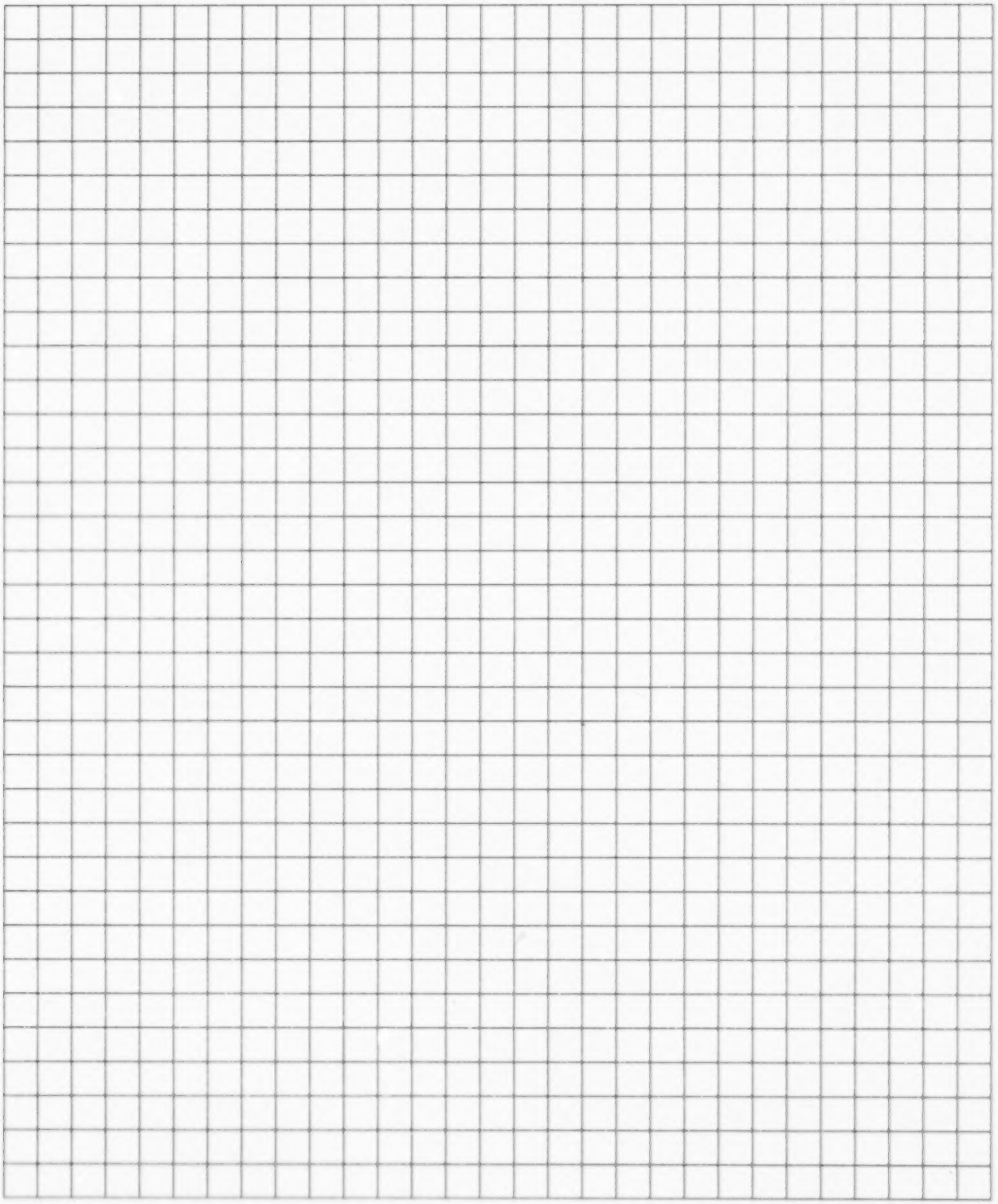
$\frac{1}{4}$–Inch Grid Paper

For use with "I Am an Architect," pages 4–5, "Egyptian Pyramids," pages 14–15, and "Outdoor Design," pages 38–39.



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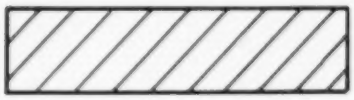
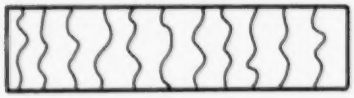
Material Rendition

For use with "Building Materials," pages 8–9.

Brick



Ceramic Tile



Concrete Block

Glass

Marble

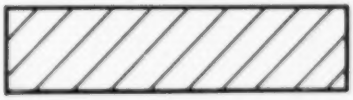
Wood Paneling

Aluminum

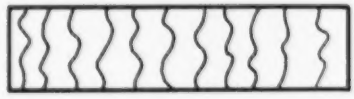
Brass-Bronze

Steel

Brick

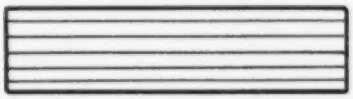


Ceramic Tile



Concrete Block

Glass



Marble

Wood Paneling

Aluminum

Brass-Bronze

Steel

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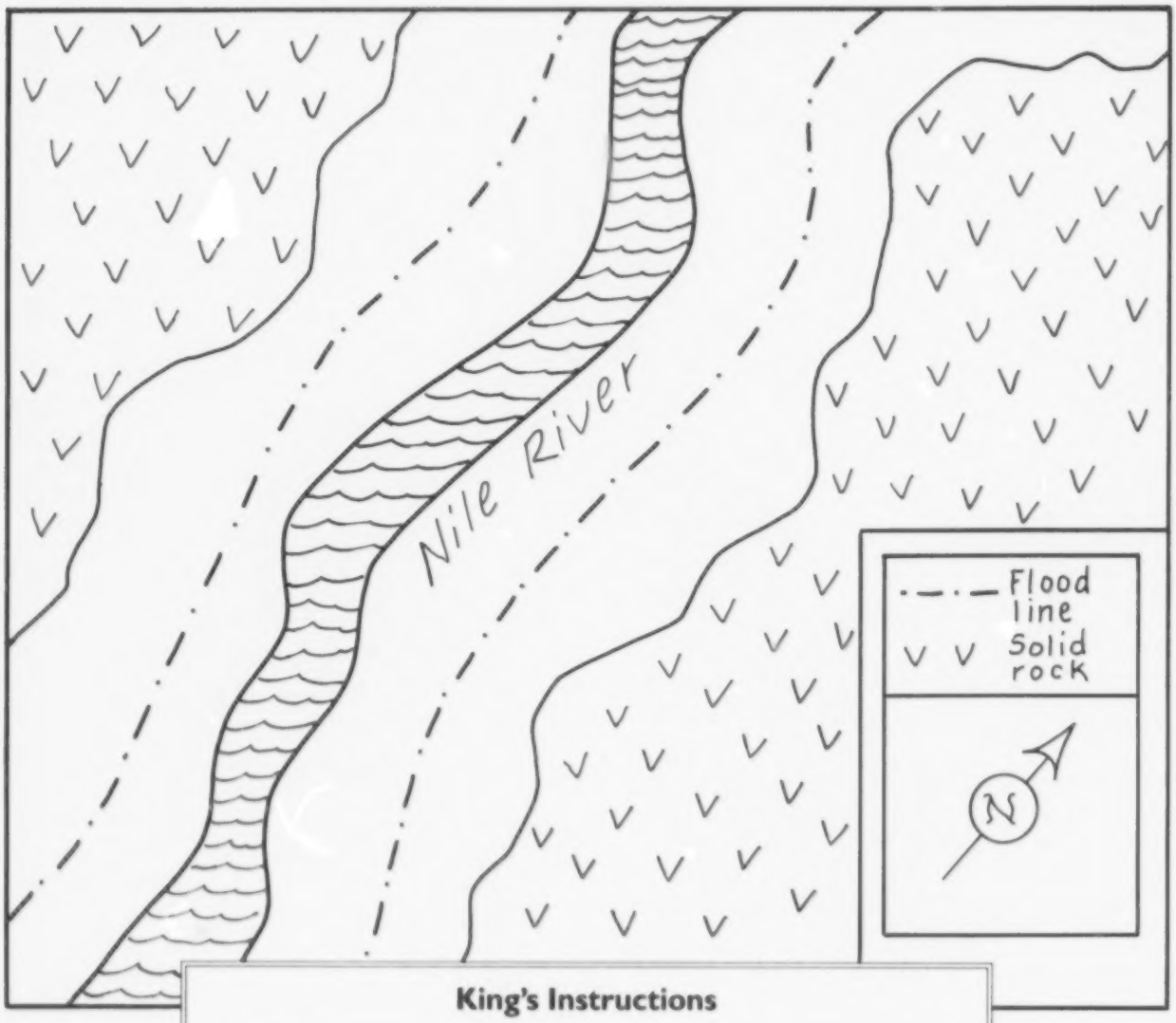
A King's Map

For use with "Egyptian Pyramids," pages 14–15.



King's Instructions

When I die,

- *I will travel into the west with the sun. As a result, my pyramid should be built on the west side of the Nile River where the sun sets.*
- *My pyramid needs to be close to the river so ships can carry the stones to the construction site.*
- *My pyramid has to be high above the river's flood line.*
- *My pyramid has to be built on solid rock so it won't sink.*
- *The sides of my pyramid have to face exactly north, south, east, and west.*

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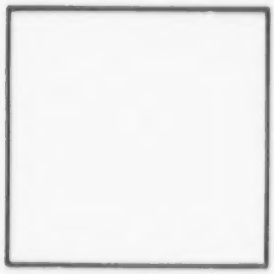
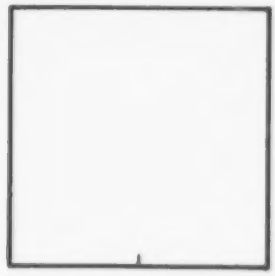
The Golden Ratio

For use with "Classical Greek Order," pages 16–17.

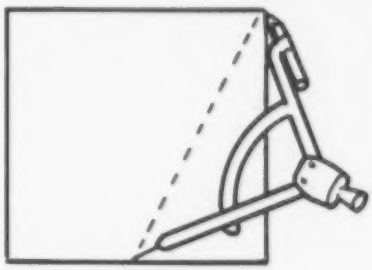
1. Draw a square.



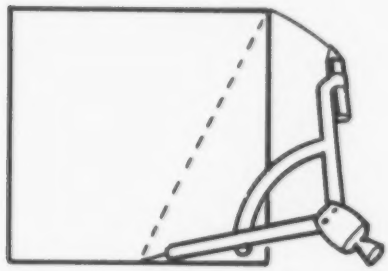
2. Find the midpoint of the base.



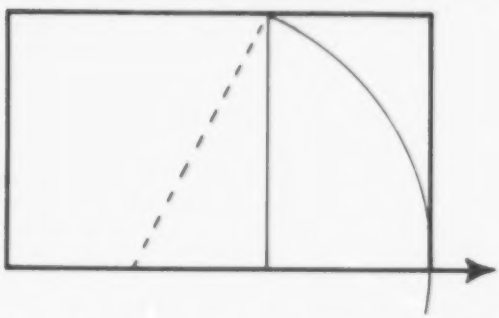
3. Set the compass the length from the midpoint to the upper right corner.



4. Draw an arc with the point of your compass on the midpoint.



5. Extend the base of the square to intersect the arc. Complete the new rectangle.



6. What is the length and width of your new rectangle? What is the proportion of the width to the length? Are all proportions the same regardless of the size of the initial square?

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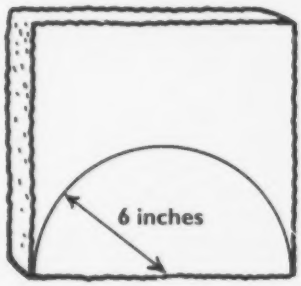
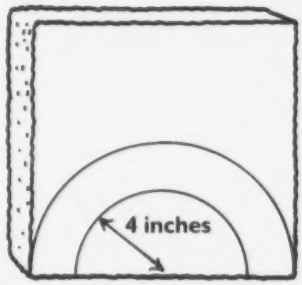
A Roman Arch

For use with "Roman Arch and Vault," pages 18–19.

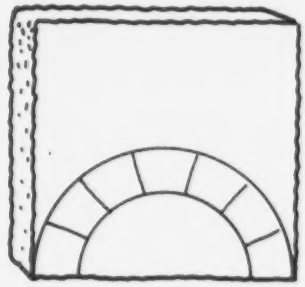
1. Take a 1-inch thick piece of square Styrofoam, measuring at least 12 inches on a side. Draw a semicircle with a radius of 6 inches.



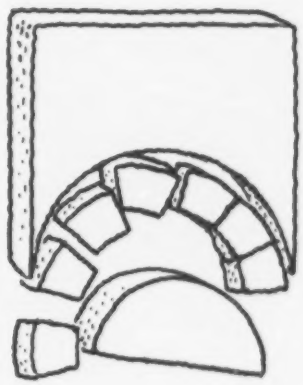
2. Draw another semicircle with a radius of 4 inches within the first semicircle.



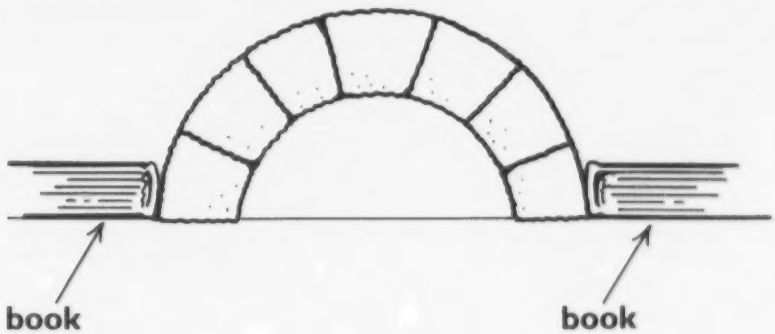
3. Divide the space between the two semicircles into equal sections, using an uneven number of sections.



4. Cut out the "stones."



5. Use books to hold up the ends of the arch. Then build the arch stone by stone. (Use tape to keep the stones temporarily in place.) The top or last stone is called the "keystone."



6. What forces keep the stones in place?

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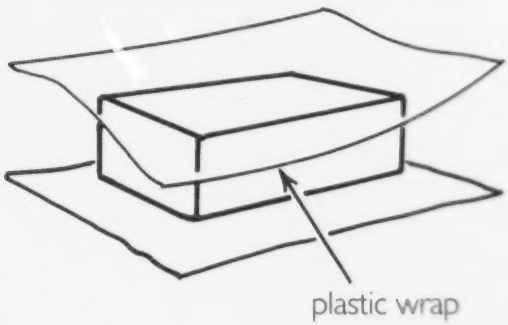
Mud-Brick House

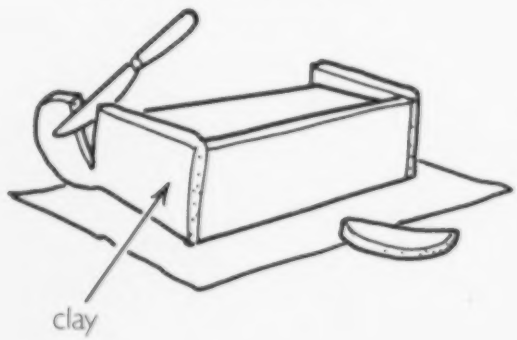
For use with "Islamic Architecture," pages 24–25.

Materials: clay, a rolling pin, plastic wrap, a shoe box, a plastic knife, poster paints

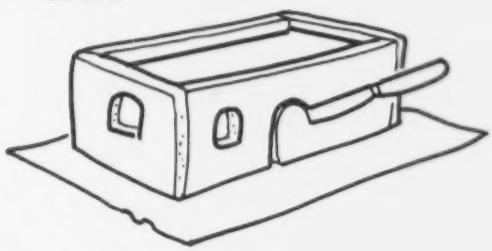
1. Cover the box with plastic wrap.



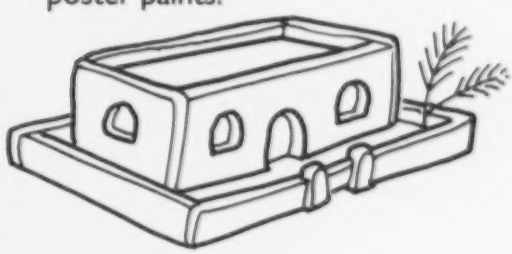
2. Roll out the clay with a rolling pin. Lay it over the box and trim it.



3. Use the plastic knife to cut windows and doors.



4. When your house is dry, paint it with poster paints.



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Curriculum Chart

	Language Arts	Mathematics	Science	Social Studies	Art
Form and Function **pp. 2–3**	• brainstorming • writing captions	• identifying shapes • displaying data graphically • taking a survey		• thinking about function	• painting a mural • designing a nonfunctional school • sketching
I Am an Architect **pp. 4–5**	• reading nonfiction • developing interviewing skills • interpreting a quotation • writing a biography	• using a scale • identifying shapes		• researching educational requirements • researching tools of an architect	• drawing from a perspective • drawing a plan
On the Construction Site **pp. 6–7**	• preparing questions • brainstorming • writing an advertisement	• creating a bid	• investigating principle of a lever • understanding principle of a wedge	• visiting a construction site • reading a blueprint • exploring occupations • making a legend	• making a collage
Building Materials **pp. 8–9**	• brainstorming • reading fiction • writing a letter • identifying nouns • writing riddles	• finding percents • identifying patterns	• identifying properties	• understanding symbols	• making an architectural drawing • creating wall rubbings
All About Structure **pp. 10–11**	• reading nonfiction • reading a short story aloud • writing from a perspective		• investigating the strength of structures • investigating effects of slope on building • experimenting the strength of different brick arrangements • observing and hypothesizing		• building straw structures

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Curriculum Chart

	Language Arts	Mathematics	Science	Social Studies	Art
Environmental Influences pp. 12–13	• brainstorming • reading nonfiction • writing from a different perspective	• calculating altitude • drawing angles	• testing wind resistance of structures	• effects of climate on architectural style • exploring environmental influences on architecture • finding locations on a map	• designing a wind resistant structure • designing a building using materials in the environment
Egyptian Pyramids pp. 14–15	• writing reasons • writing a persuasive letter	• making a scale model • finding area • writing and solving problems		• making a time line • understand B.C. and A.D.	• making a clay model
Classical Greek Order pp. 16–17	• writing a brochure • writing a report • interpreting a phrase • making and comparing lists	• finding the golden ratio	• investigating strength of columns	• adding to time line • researching lifestyles	• designing a brochure • designing a new column • designing a building façade
Roman Arch and Vault pp. 18–19	• writing a comic strip • listening to myths • writing myths	• measuring • finding area of a circle	• investigating forces on an arch	• identifying architectural styles • adding to time line	• drawing a comic strip
Medieval Castles and Cathedrals pp. 20–21	• writing a tourist brochure • writing reasons	• identifying geometric shapes	• identifying forces on walls	• adding to time line • reading topographical maps	• designing a brochure • making models • making stained glass windows • making a gargoyle • designing a maze • designing a coat of arms

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Curriculum Chart

	Language Arts	Mathematics	Science	Social Studies	Art
Chinese and Japanese Style **pp. 22–23**	• writing haiku	• identifying symmetry and asymmetry • writing and solving problems			• creating a "notan" design • drawing curves • building a model pagoda
Islamic Architecture **pp. 24–25**	• brainstorming • writing metaphors • writing a travel article	• researching and using different numeral systems		• identifying geography and climate	• building a model mud-brick house • making a mosaic
Pre-Columbian Architecture **pp. 26–27**	• writing a journal entry • finding foreign word definitions	• using problem solving skills		• finding locations on a map • researching • examining historical perspectives • exploring occupations	• constructing a temple-pyramid • making a bas-relief
Native American Dwellings **pp. 28–29**	• writing a TV documentary • brainstorming • defining words • writing a description		• designing an experiment	• researching Native American Indian dwellings and lifestyles	• making a diorama • constructing a Native American Indian dwelling
At Home in North America **pp. 30–31**	• reading nonfiction • writing a tour guide • writing similes • writing a report	• identifying geometric shapes • drawing geometric shapes		• identifying location of settlers • making a map • researching history of a local building	• designing a tour guide • making sketches • designing a Dutch barn decoration
Looking at Modern Architecture **pp. 32–33**	• reading fiction and nonfiction • writing a description	• building an icosahedron			• drawing buildings • making a book • designing a "duck" • constructing towers • forming shapes with Plaster of Paris

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Curriculum Chart

	Language Arts	Mathematics	Science	Social Studies	Art
Touching the Sky **pp. 34–35**	• identifying adjectives • writing a poem • writing captions • writing an explanation	• displaying data graphically • using problem solving skills	• making a model of a rope and pulley elevator • investigating forces on foundations	• exploring occupations • researching architects and skyscrapers	• drawing a skyscraper
Building Bridges **pp. 36–37**	• writing limericks • writing riddles	• displaying data graphically • using problem solving skills	• classifying bridges • investigating span lengths • investigating strength of cantilevered bridges • designing a truss bridge and testing its strength • investigating center of gravity	• researching and locating bridges	• illustrating limericks
Outdoor Design **pp. 38–39**	• reading a biography • writing a persuasive letter • reading fiction • writing a description	• using scale • creating tessellations	• identifying climate zones • comparing types of soils • designing a soil experiment		• creating a site development plan
Architects in the Animal World **pp. 40–41**	• writing analogies • writing captions • writing from a perspective • writing reasons	• measuring • using problem solving skills	• observing change • researching animal and insect homes	• identifying reasons for building • researching skills	• designing a building using a form from nature • sketching • making a model animal or insect home
Final Presentation **pp. 42–43**	• making a class encyclopedia • playing charades • writing a cover letter	• using scale		• researching cultures	• illustrating • making floor plans and model dream homes

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Resource List

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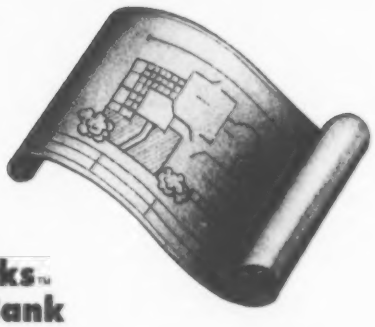

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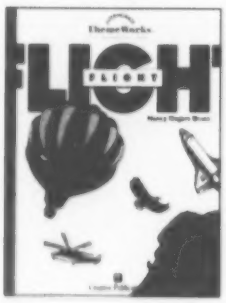

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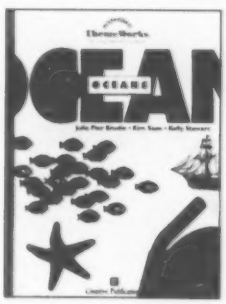

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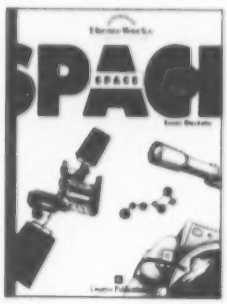

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